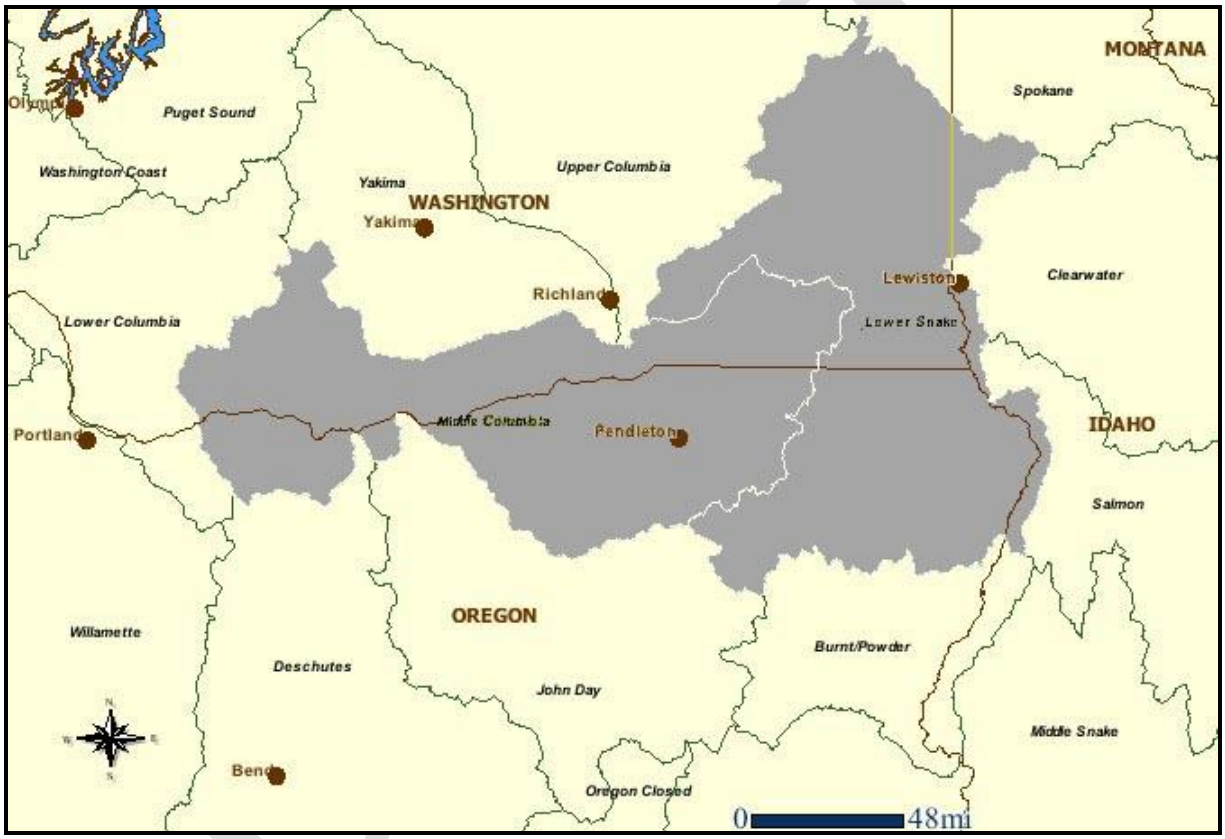
U.S. Fish & Wildlife Service - Pacific Region

Columbia Basin Hatchery Review Team

Columbia River Basin
Columbia Plateau and Blue Mountain Provinces

Lower Snake Mainstem, Grande Ronde, Tucannon, Touchet, and Walla Walla River Watersheds



Washington Lower Snake River Compensation Plan State Operated Hatcheries

Lyons Ferry and Tucannon Fish Hatcheries

Assessments and Recommendations

Draft Report, September 2009

Please cite as:

U.S. Fish and Wildlife Service (USFWS). 2009. *Washington Lower Snake River Compensation Plan State Operated Hatcheries: Assessments and Recommendations. DRAFT Report, September 2009*. Hatchery Review Team, Pacific Region. U.S. Fish and Wildlife Service, Portland, Oregon. Available at: http://www.fws.gov/Pacific/fisheries/Hatcheryreview/reports.html.

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Summary

Long-term conservation needs of natural salmonid populations and their inherent genetic resources require a reexamination of the role of hatcheries in basin-wide management and conservation strategies. Hatcheries must be viewed as part of the environmental and ecological landscape to help achieve both conservation and harvest goals. These goals need to be part of a holistic and integrated strategy that combines habitat, hydropower and harvest needs for conserving and managing fishery resources. These strategies must establish short- and long-term goals for both hatchery-propagated and naturally-spawning populations.

To ensure that its hatchery programs are best meeting conservation and harvest goals, the US Fish and Wildlife Service (Service) began, in October 2005, a four-year review of 21 salmon and steelhead hatcheries that the Service owns or operates in the Columbia River Basin. The review was expanded in 2008 to include three National Fish Hatcheries on the Olympic Peninsula of Washington State. The goal of these reviews is to ensure that Service hatcheries are operated in accordance with best scientific principles, and contribute to sustainable fisheries and the conservation of naturally-spawning populations of salmon, steelhead and other aquatic species. The Service's review process is modeled after the Puget Sound and Coastal Washington Hatchery Reform Project which was completed in 2005 and subsequently expanded to the Columbia River[1]. The Service plans to complete its reviews by mid-2010.

The report presented here provides benefit/risk assessments and recommendations for salmon and steelhead propagation programs conducted at Lyons Ferry Fish Hatchery (FH), Tucannon FH, and associated satellite facilities where juvenile fish are released and/or adults are trapped for broodstock. Lyons Ferry FH is located on the north shore of the Snake River (river mile 59.1) immediately downstream from the mouth of the Palouse River. The Tucannon FH is located along the Tucannon River, between the towns of Dayton and Pomeroy Washington, at RM 36. The Tucannon River enters the south side of the Snake River nearly opposite the Palouse River. Both hatcheries are operated by the Washington Department of Fish and Wildlife (WDFW). Programs at those two hatcheries operate cooperatively as part of the Lower Snake River Compensation Plan (LSRCP), a federally funded program to mitigate for fish losses associated with four "run-of-the-river" hydroelectric and transportation dams on the lower Snake River in Washington State. The report presented here is one of three reports for federal hatcheries operated by the states as part of the LSRCP; complementary reports exist for Idaho and Oregon.

The Review Team considered, as a foundation for its assessments, four characteristics of each salmonid stock in watersheds where fish are released as part of the LSRCP in Washington: *biological significance*, *population viability*, *habitat* conditions, and *harvest* goals. The Review Team attempted to use both short- (15 years) and long-term (50–75 years) goals for each salmonid stock, as identified by the fishery comanagers[2], as a foundation for assessing the benefits and risks of the reviewed hatchery programs. Source documents not readily available to the general public, including appendices and background documents for this report, are accessible via the Service's hatchery review website.[3]

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[1] *www.hatcheryreform.us*

[2] *LSRCP comanagers in Idaho are the U.S. Fish and Wildlife Service, IDFG, Nez Perce Tribe, Shoshone-Bannock Tribes, with comanaging input from the National Marine Fisheries Service (NOAA Fisheries).*

[3] *www.fws.gov/Pacific/fisheries/HatcheryReview/*

Lyons Ferry and Tucannon Fish Hatcheries

Lyons Ferry FH, facility overview: Lyons Ferry FH is located at river mile (RM) 59 of the Snake River adjacent to the reservoir pool behind Lower Monumental Dam. The hatchery was constructed under the LSRCP Program to offset fish losses caused by the construction and operation of four hydropower dams on the lower Snake River. The hatchery was completed and became operational in 1984. The hatchery rears Snake River fall Chinook, Tucannon River spring Chinook (in collaboration with Tucannon FH), four stocks of steelhead, and two stocks of rainbow trout. Four satellite acclimation facilities are associated with the hatchery: *Captain Johns Acclimation Facility* (AF) on the Snake River between Asotin, Washington and the mouth of the Grand Ronde River at RM 164 (fall Chinook release site); *Pittsburg Landing AF* at RM 215 of the Snake River, approximately 31 miles downstream from Hells Canyon Dam (fall Chinook release site); *Big Canyon AF* at RM XX of the Clearwater River (fall Chinook release site); *Cottonwood Creek AF* at RM 29 of the Grande Ronde River at Cottonwood Creek (steelhead release and adult broodstock collection site); and *Dayton Pond AF* at RM 53 of the Touchet River within the Walla Walla River watershed (steelhead release and adult broodstock collection site). The principle water source for rearing fish at Lyons Ferry FH is well water which is pumped from an underground aquifer.

Tucannon FH, facility overview: Tucannon FH is located at river mile 36 of the Tucannon River, between the towns of Dayton and Pomeroy, Washington. The hatchery first became operational in 1949 as a trout hatchery operated by the Washington Department of Game.[4] Construction to remodel the hatchery for anadromous fish began in 1983 and was completed in 1986 as part of a transfer of ownership to LSRCP in 1991.[5] The hatchery currently supports steelhead, spring Chinook, and resident rainbow trout programs under the LSRCP. The *Curl Lake AF* is located at RM41 of the Tucannon River, construction of which was completed in February 1985. The hatchery is supplied with water from three sources: the Tucannon River, two wells with oxygenation, and a spring. *Curl Lake AF* is supplied with Tucannon River water.

Snake River Fall Chinook

Program overview: The program is intended to operate as an *integrated conservation and harvest* program within the lower Snake River watershed. The immediate goal of the program is to conserve and help recover fall Chinook native to the lower Snake River and tributaries. The LSRCP mitigation goal is to return 18,300 hatchery-origin fall Chinook adults upstream of Ice Harbor Dam on the lower Snake River. The long-term goal of the program is to restore fall Chinook in the lower Snake River to a sustainable level of viability that will support tribal and recreational fisheries in the Snake River region. A long-term recovery goal for fall Chinook, under the U.S. Endangered Species Act, is to restore at least one natural population in the upper Snake River upstream of the Hells Canyon dam complex (three dams). Adult fall Chinook are trapped for broodstock from returns back to Lyons Ferry FH and at Lower Granite Dam. The broodstock goal is to collect up to 5,000 adults and spawn approximately 3,500 adults (≈1,600 females) to yield 4.6 million eyed eggs. Surplus adults collected in excess of broodstock needs are returned to the Snake River upstream of Lyons Ferry FH or Lower Granite Dam depending on where they were trapped. All spawning occurs at Lyons Ferry FH. Approximately 200,000 and 400,000 eyed eggs are transferred to the Oxbow FH (Idaho Department of Fish and Game) and Umatilla FH (Oregon

[4] The Washington Department of Game was historically responsible for managing freshwater sport fishes and game animals (deer, ducks, etc.) in Washington state. The name of the agency was subsequently changed to the Washington Department of Wildlife which later was merged with the Washington Department of Fisheries to form the current Washington Department of Fish and Wildlife.

[5] The USFWS accepted the transfer of ownership from the Army Corps of Engineers on March 25, 1991.

Department of Fish and Wildlife), respectively, for hatching, rearing, and release of subyearling smolts into the Hells Canyon reach of the Snake River. Approximately 420,000 eyed eggs are transferred to the Irrigon FH (Oregon Department of Fish and Wildlife) for hatching, rearing, and release of subyearling smolts into the lower Grande Ronde River. Approximately 3.0 M eyed eggs are retained on station for hatching and rearing. These latter fish are released at Lyons Ferry FH (200,000 subyearlings + 450,000 yearlings), Captain Johns AF (500,000 subyearlings + 150,000 yearlings + direct release of 200,000 subyearlings), Big Canyon AF (500,000 subyearlings + 150,000 yearlings), and Pittsburg Landing (400,000 subyearlings + 150,000 yearlings).

Benefits: Total adult returns from the hatchery program back to the Snake River have increased substantially in recent years from less that 1,000 hatchery-origin fish each year, 1983-1996, to over 10,000 fish each year, 2001-2008. Returns of natural-origin adult fall Chinook have similarly increased from less than 1,000 fish each year, 1976-1998, to a range of 2,273-6,630 adults per year, 2000-2008. As a consequence, the program appears to be conferring a significant demographic and conservation benefit. Harvest of fall Chinook in the Snake River was not allowed until 2008 when a tribal and recreational fishery was allowed for the first time since inception of the hatchery program. Only a few hundred fall Chinook were caught or harvested. WDFW estimated that 1,054 and 1,790 Lyons Ferry fall Chinook were harvested in mainstem Columbia River and ocean fisheries, respectively, in 2006.

Risks: The difficulty of trapping sufficient numbers of natural-origin adults to compose the desired 30% of the broodstock poses a long-term domestication risk to the broodstock, particularly if hatchery-origin fall Chinook outnumber natural-origin fall Chinook among naturally-spawning fish in the Snake River. The trapping of adults for broodstock only at Lyons Ferry FH and Lower Granite Dam inhibits the future development of spatial structure and between-population genetic diversity among the principle natural spawning locations in the Hells Canyon reach of the Snake River (upstream from the confluence of the Salmon River), the lower mainstem Snake River (below the confluence of the Salmon River), and the Clearwater River in the vicinity of the Big Canyon AF. The large number of hatchery-origin fall Chinook spawning in the Snake River in recent years could eventually impede the establishment of self-sustaining natural populations if hatchery-origin adults continue to far outnumber natural-origin adults on the spawning grounds. The release of yearling fall Chinook at each of three upstream acclimation sites poses an unknown competition risk to natural-origin fall Chinook. The exclusive dependence of pumped well water for all fish culture activities poses a demographic risk to the fish reared on station at Lyons Ferry FH.

Recommendations for current program: The Review Team identified 28 specific recommendations to reduce risks and/or improve benefits of the current Snake River fall Chinook program at Lyons Ferry FH. These recommendations include: (a) establish natural spawning escapement goals for the Clearwater River and the two Snake River reaches upstream and downstream of the confluence of the Salmon River, respectively; (b) improve adult trapping capabilities at Lower Granite Dam to facilitate collection of natural-origin adults for broodstock; (c) explore opportunities to collect adults for broodstock at Nez Perce Tribal Hatchery and Oxbow FH with the ultimate goal of establishing separate, self-sustaining, localized broodstocks for the Clearwater River and the Hells Canyon reach of the Snake River, respectively; (d) assess the benefits versus risks of releasing fall Chinook as yearlings and retain the yearling program only if the survival benefits clearly outweigh the cultural and ecological risks of rearing and releasing yearlings; (e) initiate a PIT tagging program for fish released as subyearlings; (f) increase monitoring and evaluation of naturally spawning fall Chinook in the Snake River, particularly with respect to the proportion of natural spawners composed of hatchery-origin fish; and (g) update public outreach displays and handouts at Lyons Ferry FH.

Alternatives to current program: The Review Team considered the pros and cons of four alternatives to the existing Snake River fall Chinook program at Lyons Ferry FH, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of all programs at Lyons Ferry FH and decommissioning the facility (Alternative 4). The Review Team recommends Alternative 2: develop an early returning stock of fall Chinook (early fall-run or late summer-run) for the Middle Fork Clearwater River upstream from the North Fork Clearwater River as a near-term alternative to reintroducing fall Chinook upstream of Hells Canyon Dam. This recommended alternative is intended to be implemented in conjunction with all the recommendations associated with Alternative 1. Together, these two recommended alternatives would establish, as a long-term goal, the establishment of four separate hatchery broodstocks and associated natural spawning aggregations (sub-populations) for fall Chinook in the lower Snake River region: early Fall (late summer-run) Middle Fork Clearwater River, lower mainstem Clearwater River, Hells Canyon Snake River, and lower mainstem Snake River (Lyons Ferry stock). The Review Team concluded that the hydrologies and water temperature profiles for each of the four regions of the lower Snake and Clearwater rivers warranted the establishment of separate hatchery broodstocks, each adapted to the local conditions, as a means of optimizing stock viabilities, spatial structure, and genetic diversity. The Team further suggests that Oxbow FH, the Nez Perce Tribal Hatchery, and Kooskia NFH could each contribute to achieving those long-range goals.

Tucannon River Spring Chinook

Program overview: The program is intended to operate as an *integrated conservation* program within the Tucannon River. The immediate goal of the program is to restore and enhance spring Chinook salmon in the Tucannon River. The LSRCP mitigation goal is to return 1,152 hatchery-origin spring Chinook adults to the Tucannon River. The long-term goal of the program is to restore spring Chinook in the Tucannon River to a sustainable level of viability that will support tribal and recreational fisheries. No harvest goal exists at the present time. Adult spring Chinook are trapped for broodstock at a permanent weir located at RM 59 immediately upstream of the Tucannon FH. The broodstock goal is to collect equal numbers of hatchery and natural-origin fish for a total of 170 adults (85 females and 85 males) to yield approximately 250,000 eyed eggs. Adults retained for broodstock are transferred to Lyons Ferry FH where spawning, hatching, and early rearing occurs. Juvenile fish (sub-yearlings) are transferred to Tucannon FH in September for subsequent rearing and then transferred as yearlings from Tucannon FH to Curl Lake AF in February for two months of acclimation prior to release. The program objective is to annually release 225,000 yearling smolts from Curl Lake AF.

Benefits: Measurable conservation benefits of this program have not been documented. The mean number of natural-origin adults returning to the Tucannon River in recent years is not greater than the mean number of natural-origin adults returning prior to 1990. The hatchery program is presumed to be serving as a "genetic reserve" and "demographic buffer" for the natural population in the Tucannon River, but the available data do not demonstrate a detectable conservation benefit. The program provides little or no harvest benefit.

Risks: The comparatively low recruit-to-spawner ratio for naturally spawning fish (R/S < 1.0 for most brood years) coupled with the high proportion of hatchery-origin spring Chinook spawning in the Tucannon River inhibits development of a "properly-integrated" hatchery program, thus posing a genetic domestication risk to the spring Chinook population in the Tucannon River. Removal of natural-origin adults for broodstock also poses a demographic risk to the natural population. Significant numbers of hatchery and natural-origin spring Chinook adults from the Tucannon River stray upstream of Lower Granite Dam, thus increasing demographic risks to the

Tucannon River populations and posing potential genetic and ecological risks to other populations. This relatively high level of straying appears to be environmentally related and not a direct cause of the hatchery program (e.g., Tucannon River steelhead show the same pattern

Recommendations for current program: The Review Team identified 17 specific recommendations to reduce risks and/or improve benefits of the current Tucannon River spring Chinook program. These recommendations include: (a) restate and prioritize program goals (e.g., conservation vs. mitigation) in terms of short-term and long-term numeric outcomes that do not conflict with each other, and develop clearly defined objectives (e.g., broodstock size and composition) that directly support those prioritized goals; (b) evaluate the need for regularly scheduled prophylactic use of erythromycin feed with the goal of phasing out its use if possible; (c) discontinue stocking catchable trout in Rainbow Lake which is a water source for Tucannon FH; (d) continue to investigate potential causes (e.g., parasites, predation by exotic fish) of low smolt productivity for naturally spawning spring Chinook in the Tucannon River; (e) conduct a genetic study of natural reproductive success of spring Chinook passed upstream of the weir on the Tucannon River; and (f) investigate the feasibility of constructing a permanent weir in the lower Tucannon River downstream from the natural spawning habitat for spring Chinook (see also recommendations for Tucannon River steelhead).

Alternatives to current program: The Review Team considered the pros and cons of six alternatives for the existing Tucannon River spring Chinook program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of the program and decommissioning the Tucannon FH (Alternative 6). The Review Team recommends Alternative 3: convert the current integrated program for Tucannon River spring Chinook to a two-stage, stepping-stone program based on the entire natural population in the Tucannon River. Implementation of this alternative would require the construction of a permanent weir in the lower Tucannon River below the primary spawning habitat for the entire population. This recommendation is intended to be implemented consistent with all recommendations in Alternative 1. The intent of this alternative is to use the first, genetically integrated broodstock to develop specific management goals and objectives for conservation of the indigenous spring Chinook population in the Tucannon River, and then subsequently develop a second broodstock - derived from returning adults of the first broodstock – to (a) provide fish for Tribal and recreational fisheries and (b) meet the LSRCP mitigation goal of 1,152 adults back to the Tucannon River.

Lyons Ferry Summer Steelhead

Program overview: The program is intended to operate as a *segregated harvest* program within the lower Snake River watershed. The "Lyons Ferry steelhead stock" is considered an "out-of-basin" composite stock derived in the early 1980's, primarily from steelhead returning to Wells Hatchery on the upper Columbia River and Wallowa Hatchery in the Grande Ronde River watershed. The Lyons Ferry FH stock is considered an "A" run steelhead, typical of most Columbia River stocks. The goal of the program is to support recreational and tribal fisheries in the lower Snake, Tucannon, Touchet, and Walla Walla rivers. The specific goal is to return a minimum of 630 adults back to the vicinity of Lyons Ferry FH for harvest and broodstock collection, 875 adults to the Tucannon River for harvest, 750 adults to the Touchet River for harvest, and 900 adults to the Walla Walla River for harvest. Broodstock collection, spawning, incubation, and juvenile rearing all occur at Lyons Ferry FH. The broodstock goal is to collect up to 1,650 adults, hold up to 400 adults for broodstock, and spawn a minimum of 106 females and 200 males to yield 460,000 eyed eggs. Approximately 150 adults per week in excess of broodstock needs are retained for reading coded wire tags; the remaining fish not retained for broodstock

(generally 1,000-1,200 adults) are returned ("recycled") to the Snake River for harvest. The program releases 60,000 yearling smolts on-station at Lyons Ferry FH, 100,000 yearling smolts into the Tucannon River (direct release), 85,000 yearling smolts into the Touchet River (acclimated release from the Dayton Pond AF), and 100,000 yearling smolts into the Walla Walla River (direct release). The total release objective of the program is 345,000 smolts.

Benefits: Annual estimated harvest of Lyons Ferry stock steelhead within the lower Snake River region averaged 3,069 adults (range = 1,565 to 4,161 adults) for broodyears 2000-2003. This total average harvest was apportioned as follows: 1,146 (range = 701-1,621) fish in the Tucannon River, 759 (range = 297-1,032) fish in the Touchet River, 788 (range 325-1,138) fish in the Walla Walla River, and 377 (range 242-593) fish in the Snake River at Lyons Ferry FH.

Risks: Lyons Ferry steelhead returning to the Tucannon River pose significant genetic risks to the natural population in the Tucannon River because a high proportion of the naturally spawning fish are composed of Lyons Ferry hatchery-origin steelhead. Similar outplanting of Lyons Ferry steelhead into the Touchet and Walla Walla rivers poses genetic risks to natural populations in those latter two rivers also; however, those risks are considered lower than in the Tucannon River because a smaller proportion of naturally spawning fish are Lyons Ferry steelhead. The outplanting of Lyons Ferry steelhead smolts into the Tucannon, Touchet, and Walla Walla rivers also poses ecological competition risks to the natural populations in those streams.

Recommendations for current program: The Review Team identified 17 specific recommendations to reduce risks and/or improve benefits of the current Lyons Ferry steelhead program at Lyons Ferry FH. These recommendations include: (a) improve the weirs in the lower Tucannon and Touchet rivers to exclude Lyons Ferry steelhead from natural spawning areas and/or reduce the number of fish released to ensure that Lyons Ferry steelhead compose less than 5% of the steelhead spawning naturally in each river; (b) reduce rearing densities in the indoor nursery tanks to be consistent with fish culture guidelines; and (c) conduct pre-release fish health exams to test for pathogens prior to transfer and release of steelhead smolts.

Alternatives to current program: The Review Team considered the pros and cons of five alternatives to the existing Lyons Ferry steelhead program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of all programs at Lyons Ferry FH and decommissioning the facility (Alternative 4). The Review Team recommends the immediate implementation of Alternative 2: (a) terminate off-station releases of Lyons Ferry steelhead into the Tucannon, Touchet and Walla Walla rivers, (b) expand the Tucannon and Touchet river endemic programs and/or increase the number of steelhead released on-site from Lyons Ferry Hatchery, and (3) implement all elements of Alternative 1 that apply to the on-station releases. These short-term goals and recommendations are consistent with the recommendations for the endemic steelhead programs in the Tucannon and Touchet rivers (see below). The Team further recommends, as a long-term goal, replacement of the Lyons Ferry steelhead stock with a stock indigenous to the Snake River. The Team concluded that the out-of-basin Lyons Ferry stock is inappropriate for long-term use in the Snake River Basin. The pros and cons of potential candidate stocks would need to be evaluated by comanagers before a specific stock is selected.

Cottonwood Creek Summer Steelhead

Program overview: The program is intended to operate as a *segregated harvest* program within the lower Grande Ronde river. The goal of the program is to return approximately 1,500 adult steelhead back to the lower Grande Ronde River for harvest and broodstock collection. The

Cottonwood Creek steelhead stock is considered an "out-of-basin" composite stock. It was derived exclusively from the Wallowa Hatchery stock of steelhead which, in turn, was originally derived from trapping adult steelhead at Ice Harbor and Little Goose dams in the early 1980's. The stock is therefore likely made up of both "A" and "B" run steelhead from the Snake River basin, and could include fish that originated from the Clearwater, Salmon and Grande Ronde river basins. A permanent adult trapping facility was installed in Cottonwood Creek to trap broodstock beginning in 1992. The broodstock goal is to annually collect and spawn 150 hatchery-origin (marked) steelhead (50 females) at the Cottonwood Creek trap. All unmarked adults and marked adults in excess of broodstock needs are passed upstream of the weir. In recent years, more than 1,000 fish have been passed annually upstream. Gametes are collected at the trap and transported to Lyons Ferry FH where the eggs are fertilized and incubated. The resulting fish are reared at Lyons Ferry FH until transferred to the Cottonwood Pond AF prior to release. The program objective is to release 160,000 yearling smolts from the Cottonwood Pond AF adjacent to the confluence of Cottonwood Creek and the Grande Ronde River. A gravity-feed pipeline from Cottonwood Creek is the water supply for the acclimation pond, the intake for which is integrated into the adult trap on Cottonwood Creek.

Benefits: The program is conferring very significant harvest benefits in the lower Grande Ronde River. Annual estimated harvest of hatchery-origin steelhead released as smolts from the Cottonwood Pond AF averaged 2,968 (range = 1,209-5,341) fish in the lower Grande Ronde River for broodyears 1997-2003 These latter within-basin harvests substantially exceed the mitigation goal of 1,500 fish and accounted for 86.5% of the total estimated harvest on Cottonwood Creek hatchery steelhead.

Risks: The genetic effective number of breeders for propagating the Cottonwood Creek hatchery stock of steelhead is less than desired for maintaining genetic viability of the stock over many generations. High holding densities at the adult trap on Cottonwood Creek increase disease risks among adult steelhead trapped for broodstock. The deliberate passage of large numbers of adult steelhead (n > 1,000 fish/year) upstream of the trap on Cottonwood Creek poses fish health risks to juveniles held in the Cottonwood Pond AF because of the high likelihood that adult steelhead will shed pathogens into the water supply for the pond. The passage of large numbers of steelhead in Cottonwood Creek, far in excess of the stream's apparent carrying capacity, also poses water quality risks to that small stream. Wallowa stock steelhead, including the Cottonwood Creek strain released in the Grande Ronde River, stray at a relatively high rate into the Deschutes and John Day rivers, thus posing genetic risks to the natural populations in those streams.

Recommendations for current program: The Review Team identified 15 specific recommendations to reduce risks and/or improve benefits of the current Cottonwood Creek steelhead program. These recommendations include: (a) restate program goals based on current conditions, realized smolt-to-adult return rates, and harvest opportunities in the lower Grande Ronde River relative to areas downstream; (b) explicitly state the desired benefits intended from passing hatchery-origin steelhead upstream of the adult trap in Cottonwood Creek, and discontinue that passage if the fish health and ecological risks outweigh the realized benefits, in which case, find alternative beneficial uses for surplus adults (e.g., transfer to food banks); (c) increase the number of adults spawned for broodstock to 75 females and 150 males, and cull each family to an approximately equal number of eyed eggs to increase the effective population size of Cottonwood Creek hatchery population to approximate $N_e = 500$ for the population as a whole (3-4 broodyears per generation); (d) test a sample of 60 juvenile steelhead for pathogens prior to release, including DNA testing for a new infectious strain of IHN virus; and (e) modify the adult trap on Cottonwood Creek to increase the adult fish holding capacity, add safety railings to the top of the trap, and add security fencing around the facility.

Alternatives to current program: The Review Team considered the pros and cons of six alternatives to the existing Cottonwood Creek hatchery program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of all programs at Lyons Ferry FH and decommissioning the facility (Alternative 6). The Review Team recommends Alternative 1: continuation of the current program with implementation of all recommendations. This alternative includes the continued monitoring of Cottonwood Creek steelhead that stray into the Deschutes and John Day rivers and modifying the program in accordance with updated program goals to reduce those risks (e.g., reducing the number of fish released). Some team members felt that development of an endemic Grande River stock (Alternative 2) should be evaluated as an attempt to reduce straying risks, both within and outside the Grande Ronde River basin. However, the general consensus of the Team was that the risks of this alternative may significantly outweigh the benefits because it would require collecting broodstock from one or more ESA-listed natural populations in the lower Grande Ronde River to support a harvest mitigation program with no conservation goals, at least at the present time.

Touchet River (endemic) Summer Steelhead

Program overview: The program is intended to operate as an *integrated research* program to test the efficacy of developing an endemic hatchery program to replace the outplanting of Lyons Ferry steelhead in the Touchet River. The ultimate goal of the current program is to develop protocols that will achieve an overall smolt-to-adult return rate (SAR) back to the Touchet River comparable to the current SARs for Lyons Ferry steelhead. If that research goal is achieved, then the release of Lyons Ferry steelhead would be terminated and the Touchet River program would be expanded to meet LSRCP mitigation goals and harvest goals for steelhead in the Touchet River. At the present time, the broodstock goal is to annually collect and spawn 32 natural-origin (unmarked-untagged) steelhead (16 females) from the Touchet River to yield 50,000 smolts for release back into the Touchet River. Adults retained for broodstock are transferred to Lyons Ferry FH for spawning. Fertilization, incubation, and rearing of juvenile steelhead occur at Lyons Ferry FH. Yearling steelhead are transported to the Touchet River and directly released upstream of a permanent weir. All hatchery-origin steelhead from the Touchet River endemic stock are released unmarked (no fin clips) but tagged (PIT, VIE, or CWT)[6]. All unmarked-untagged (natural-origin) fish in excess of broodstock needs and all unmarked-tagged (Touchet River hatchery-origin) fish are passed upstream of the weir to spawn naturally.

Benefits: Smolt-to-adult return rates for the Touchet River endemic steelhead (SAR < 0.5%) have been substantially lower than those for Lyons Ferry steelhead (mean SAR ≈ 1.6%). The protracted return and spawn timing of natural-origin adults in the Touchet River has impeded the ability to rear smolts to the desired size within one year. As a result, a significant proportion of the fish released from the Touchet River endemic program are below the minimum size necessary to maximize post-release survivals and SARs back to the release locations.

Risks: The comparatively small effective breeding number of the broodstock (mean $N_b = 28$), coupled with the deliberate upstream passage of hatchery-origin progeny from those parents, poses a genetic risk to the natural population upstream of the weir by reducing the effective population size of the natural population. Collection of adults for broodstock emphasizes the early-returning portion of the run which, over the long term, can impose artificial selection for earlier run timing in the natural population when hatchery-origin fish are allowed to spawn naturally. Significant

[6] *Passive Integrative Transponders (PIT), Visual Implant Elastomer (VIE), or Coded-Wire tags (CWT).*

numbers of Touchet River hatchery-origin steelhead appear to be straying upstream of Ice Harbor Dam.

Recommendations for current program: The Review Team identified 14 specific recommendations to reduce risks and/or improve benefits of the current Touchet River endemic steelhead program. These recommendations include: (a) define more precisely the specific goal and purpose of the research program and restrict management actions to only those operations that directly support that specific goal (e.g., the current release of hatchery-origin fish upstream of the weir does not support the research goal of the program, but it creates risks); (b) collect adult steelhead for broodstock from the entire spectrum of the run to minimize artificial selection for run and/or spawn timing; (c) discontinue passing hatchery-origin adults upstream of the weir but, instead, either (i) cross them pairwise with natural-origin fish as part of the broodstock and/or (ii) adjust the research goals and data collection protocols to justify passage of hatchery fish upstream (i.e., hatchery fish should not be passed upstream without a specified desired benefit that is subsequently evaluated); (d) discontinue outplanting fry that are the progeny of females that test positive for IHN virus; (e) investigate the use of heated water and/or releasing juveniles as two-year old smolts to achieve the desired size at release; and (f) determine whether acclimated releases from Dayton Pond increase SARs compared to direct releases upstream of the weir (see also recommended alternative for Lyons Ferry hatchery steelhead)

Alternatives to current program: The Review Team considered the pros and cons of five alternatives to the current Touchet River endemic steelhead program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of the Touchet River endemic steelhead research program (Alternative 5). The Review Team recommends Alternative 2: phase-out or terminate the release of Lyons Ferry hatchery steelhead in the Touchet River and expand the current integrated endemic program with the goal of eventually developing a two-stage, stepping-stone program that can support both harvest and conservation goals. Alternative 2 is intended to be implemented consistent with all the recommendations in Alternative 1. The Review Team concluded that adult return rates back to the Touchet River from the current endemic program were sufficient to expand the program for the immediate purpose of continuing the research goals of the program and addressing conservation needs for steelhead in the Touchet River. For example, hatchery-origin fish from the current program could be crossed pairwise or in a spawning matrix with natural-origin fish to double the number of smolts released with no additional impact on the natural population. Returning hatchery-origin adults from this integrated broodstock could then be spawned amongst themselves as a second broodstock to produce fish that are marked (fin-clipped) for harvest prior to release. The Review Team concluded that terminating the release of Lyons Ferry steelhead in the Touchet River would facilitate an expanded research program (e.g., use of Dayton pond to compare SARs for acclimated fish vs. direct-released fish) with the long-term goal of developing a conservation and harvest stepping stone (two broodstock) program if the necessary protocols and desired SARs can be achieved.

Tucannon River (endemic) Summer Steelhead

Program overview: The program is intended to operate as an *integrated research* program to test the efficacy of developing an endemic hatchery program to replace the outplanting of Lyons Ferry steelhead in the Tucannon River. The ultimate goal of the current program is to develop protocols that will achieve an overall smolt-to-adult return rate (SAR) back to the Tucannon River comparable to the current SARs for Lyons Ferry steelhead. If that research goal is achieved, then the release of Lyons Ferry steelhead would be terminated and the Tucannon River program would be expanded to meet LSRCP mitigation goals and harvest goals for steelhead in the Tucannon

River. At the present time, the broodstock goal is to annually collect and spawn 30 natural-origin (unmarked-untagged) steelhead (15 females) from the Tucannon River to yield 50,000 smolts for release back into the Tucannon River. Adults are collected for broodstock at a temporary weir at RM 24 and a permanent weir at RM 35 of the Tucannon River. Fish retained for broodstock are transferred to Lyons Ferry FH for spawning. Fertilization, incubation, and rearing of juvenile steelhead occur at Lyons Ferry FH. Yearling steelhead are transported to the Tucannon FH for acclimation prior to release. After a couple months, fish are transported and directly released at RM 42 of the Tucannon River. All hatchery-origin steelhead from the Tucannon River endemic stock are released unmarked (no fin clips) but tagged (PIT, VIE, or CWT)[7]. All unmarked-untagged (natural-origin) fish in excess of broodstock needs and all unmarked-tagged (Tucannon River hatchery-origin) fish are passed upstream of the weir to spawn naturally.

Benefits: Smolt-to-adult return rates for Tucannon River endemic steelhead (SAR ≈ 1.0% in recent years) have been substantially higher than those for the Touchet River steelhead but still less than those for Lyons Ferry steelhead (mean SAR ≈ 1.3%). The Tucannon River program has been more successful at achieving the desired release objective of 50,000 smolts and the desired mean size (100 g/fish) than the Touchet River program. Nevertheless, like the Touchet River program, the protracted return and spawn timing of natural-origin adults in the Tucannon River has been a difficult component of broodstock collection and subsequent juvenile rearing.

Risks: The comparatively small effective breeding number of the broodstock (mean $N_b < 36$), coupled with the deliberate upstream passage of hatchery-origin progeny from those parents, poses a genetic risk by reducing the effective population size of the natural population in the Tucannon River. Collection of adults for broodstock emphasizes the early-returning portion of the run which, over the long term, can impose artificial selection for earlier run timing in the natural population when hatchery-origin fish are allowed to spawn naturally. The location of the permanent weir above 40% of the primary spawning area for the natural population, and the inefficient temporary weir below the primary spawning area, prevent efficient management of the proportion of naturally-spawning fish composed of hatchery-origin steelhead, thus contributing to genetic and ecological risks. Significant numbers of Tucannon River hatchery-origin steelhead stray to the Snake River.

Recommendations for current program: The Review Team identified 14 specific recommendations to reduce risks and/or improve benefits of the current Tucannon River endemic steelhead program. These recommendations include: (a) define more precisely the specific goal and purpose of the research program and restrict management actions to only those operations that directly support that specific goal (e.g., the current release of hatchery-origin fish upstream of the weir does not support the research goal of the program, but it creates risks); (b) collect adult steelhead for broodstock from the entire spectrum of the run to minimize artificial selection for run and/or spawn timing; (c) discontinue the deliberate passing of hatchery-origin adults upstream of the weirs but, instead, either (i) cross them pairwise with natural-origin fish as part of the broodstock and/or (ii) adjust the research goals and data collection protocols to justify passage of hatchery fish upstream (i.e., hatchery fish should not be passed upstream without a specified desired benefit that is subsequently evaluated); (d) discontinue outplanting fry that are the progeny of females that test positive for IHN virus; (e) investigate the feasibility of constructing a permanent weir in the lower Tucannon River, below the primary spawning areas; and (f) continue to investigate the degree and potential causes of straying of hatchery and natural-origin steelhead (and spring Chinook) past the Tucannon River and upstream of Lower Granite Dam, and

[7] *Passive Integrative Transponders (PIT), Visual Implant Elastomer (VIE), or Coded-Wire tags (CWT).*

experiment with potential methods to reduce straying (e.g., artificial imprinting to an organic chemical additive in the acclimation water supply at Tucannon FH).

Alternatives to current program: The Review Team considered the pros and cons of five alternatives to the current Tucannon River endemic steelhead program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of the Tucannon River endemic steelhead research program (Alternative 5). The Review Team recommends Alternative 2: phase-out or terminate the release of Lyons Ferry hatchery steelhead in the Tucannon River and expand the current integrated endemic program with the goal of eventually developing a two-stage, stepping-stone program that can support both harvest and conservation goals. Alternative 2 is intended to be implemented consistent with all the recommendations in Alternative 1. The Review Team concluded that adult return rates back to the Tucannon River from the current endemic program were sufficient to expand the program for the immediate purpose of continuing the research goals of the program and addressing conservation needs for steelhead in the Tucannon River. For example, hatchery-origin fish from the current program could be crossed pairwise or in a spawning matrix with natural-origin fish to double the number of smolts released with no additional impact on the natural population. Returning hatchery-origin adults from this integrated broodstock could then be spawned amongst themselves as a second broodstock to produce fish that are marked (fin-clipped) for harvest prior to release. The Review Team concluded that terminating the release of Lyons Ferry steelhead in the Tucannon River would facilitate an expanded research program with the long-term goal of developing a conservation and harvest stepping stone (two broodstock) program if the necessary protocols and desired SARs can be achieved. This recommended alternative includes construction of a permanent weir on the Tucannon River downstream from the natural spawning areas for steelhead (and spring Chinook).

Spokane [strain] rainbow trout

Program overview: This program is intended to provide 67,500 angler-days of fishing in Washington and Idaho in partial fulfillment of LSRCP mitigation obligations. A total of approximately 500,000 eyed rainbow trout eggs are transferred from the Spokane Trout Hatchery (WDFW) to Lyons Ferry FH and Tucannon FH for hatching and initial rearing. Approximately 160,000 subyearling rainbow trout fry are transferred from Lyons Ferry FH to Idaho Department of Fish and Game (IDFG) for stocking inland lakes and ponds in Idaho. Approximately 100,000 yearling rainbow trout are transferred from Lyons Ferry FH and stocked in various lakes in southeast Washington. Similarly, approximately 138,000 yearling rainbow trout are transferred from Tucannon FH and stocked in lakes and reservoirs (impoundments) in southeast Washington.

Benefits: Limited harvest data exists for the rainbow trout program. A 2003 report by WDFW indicated that program supported 38,116 angler-hours and 19,749 angler-days of fishing effort. IDFG has no harvest or angler effort data for the rainbow trout stocked in Idaho.

Risks: Spokane rainbow trout are susceptible to bacterial coldwater disease which reduces survival. In addition, the rearing of those fish at Tucannon FH and Lyons Ferry FH increases fish health risks to Chinook salmon and steelhead at both facilities. Rainbow trout at Lyons Ferry FH compete with anadromous fish for space and water.

Recommendations for current program: The Review Team identified four specific recommendations to reduce risks and/or improve benefits of the current Touchet River endemic steelhead program. These recommendations include: (a) develop a monitoring program to determine whether the rainbow trout program is meeting its LSRCP mitigation goal; (b)

investigate the potential use of another strain of rainbow trout that are less susceptible to bacterial coldwater disease; and (c) conduct pre-release fish health exams on samples of 60 fish at both hatcheries.

Alternatives to current program: The Review Team considered the pros and cons of three alternatives to the current Spokane rainbow trout program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of the program (Alternative 3). The Review Team recommends Alternative 2: transfer the Spokane rainbow trout program to a WDFW inland trout facility. Implementation of Alternative 2 would increase rearing space available to salmon and steelhead at Lyons Ferry FH and Tucannon FH, and would also reduce fish health risks at both facilities.

Kamloops [strain] rainbow trout

Program overview: This program is intended to provide 67,500 angler-days of fishing in Idaho in partial fulfillment of LSRCP mitigation obligations. IDFG transfers approximately 70,000 triploid (genetically sterile) eyed Kamloops rainbow trout eggs from IDFG's Hayspur Hatchery to Tucannon FH each year. The eggs are hatched at Tucannon FH and the resulting subyearling fry (≈ 52,000) are transferred to Lyons Ferry FH in July of each year for subsequent rearing. The fish are given an adipose fin clip and either a right or left ventricle fin clip (alternating each year). IDFG transports and stocks the entire population of approximately 50,000 subyearling rainbow trout in the lower Salmon and lower Clearwater rivers at ≈15 fish per pound.

Benefits: Although IDFG samples the lower Clearwater and lower Salmon rivers to determine the presence/absence of program fish, harvest benefits are not adequately documented

Risks: The rearing of Kamloops rainbow trout at Tucannon FH and Lyons Ferry FH increases fish health risks to Chinook salmon and steelhead at both facilities. Rainbow trout at Lyons Ferry FH compete with anadromous fish for space and water.

Recommendations for current program: The Review Team identified four specific recommendations to reduce risks and/or improve benefits of the current Kamloops rainbow trout program. These recommendations include: (a) develop a monitoring program to determine whether the rainbow trout program is meeting its LSRCP mitigation goal; (b) increase sampling efforts in the lower Salmon and Clearwater rivers to determine the extent of predation by Kamloops rainbow trout on anadromous fish, and discontinue stocking those fish in anadromous waters if predation is detected; and (c) conduct pre-release fish health exams on samples of 60 fish prior to transport from Lyons Ferry FH.

Alternatives to current program: The Review Team considered the pros and cons of three alternatives to the current Kamloops rainbow trout program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1) to (b) termination of the program (Alternative 3). The Review Team recommends Alternative 2: transfer the Kamloops rainbow trout program to another facility. Implementation of Alternative 2 would increase rearing space available to salmon and steelhead at Lyons Ferry FH and Tucannon FH, and would reduce fish health risks at both facilities.

Conclusions

(To be provided in Final Report)

I. Introduction

In the past 150 years, habitat alterations, hydroelectric development and consumptive fisheries have affected the productivity, abundance, spatial distribution, and diversity of natural populations of Pacific salmon and steelhead (*Oncorhynchus mykiss*) in the Pacific Northwest. To mitigate for those impacts, hatcheries have been used to increase the number of fish available for harvest. However, long-term conservation needs of natural salmonid populations and their inherent genetic resources now require a reexamination of the role of hatcheries in basin-wide management and conservation strategies.

Hatcheries need to be part of a holistic and integrated strategy that combines habitat, hydropower and harvest needs for conserving and managing fishery resources. These strategies must establish short- and long-term goals for both hatchery-propagated and naturally-spawning populations. However, modifying hatchery programs and operations to achieve both conservation and harvest goals in a coordinated manner is difficult and complex. Scientific uncertainties exist regarding the ability of hatcheries and hatchery-origin fish to directly assist with recovery of naturally-spawning populations while, at the same time, sustaining major fisheries. Uncertainties also exist regarding genetic and ecological interactions between natural- and hatchery-origin fish. Only an objective, collaborative, science-based approach can address these problems in a manner that is both scientifically defensible and accepted by the public.

In an effort to improve its hatchery programs and to ensure that existing facilities are best meeting conservation and harvest goals, the U.S. Fish & Wildlife Service (Service) initiated, in October 2005, a review 21 salmon and steelhead hatcheries that the Service owns or operates in the Columbia River Basin. That review was expanded in 2008 to include three National Fish Hatcheries (NFHs) on the Olympic Peninsula of Washington State. The goal of these reviews is to ensure that Service hatcheries are operated in accordance with best scientific principles, and contribute to sustainable fisheries and the recovery of naturally-spawning populations of salmon, steelhead and other aquatic species.

This internal review is modeled after the recent Puget Sound and Coastal Washington Hatchery Reform Project conducted by the Hatchery Scientific Review Group (HSRG).[8] That project provided a solid template and operational tools (e.g. software spreadsheets, population dynamic models) for reviewing Service hatcheries in the Columbia River Basin. Much of the background information necessary for reviewing hatcheries in the Columbia River Basin has already been compiled in Hatchery and Genetic Management Plans (HGMPs),[9] Comprehensive Hatchery Management Plans (CHMPs),[10] and the Artificial Propagation Review and Evaluation (APRE)[11] database developed by the Northwest Power and Conservation Council (NWPCC).

Based on the recommendations of a Hatchery Review Working Group (Working Group),[12] the Service's Assistant Regional Director for Fisheries (ARD) assembled a Columbia Basin Hatchery

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[8] For more information on this project and fall project publications see www.hatcheryreform.org and www.hatcheryreform.us.

[9] For more information on HGMPs, visit www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Hatcheries/Hatchery-and-Genetic-Management-Plans.cfm.

[10] For more information on CHMPs, visit www.fws.gov/pacific/Fisheries/CHMP.htm.

[11] For more information on APRE, visit www.nwcouncil.org/fw/apre/.

[12] The Working Group was appointed in November 2004 by the Service's Assistant Regional Director for Fisheries, Pacific Region. The Working Group's report and all other Columbia Basin Hatchery Review documents are available from the project's website, www.fws.gov/pacific/fisheries/hatcheryreview/.

Review Team (Review Team). This Review Team, comprised of Service and other federal agency scientists, has adapted the HSRG's scientific framework, principles and hatchery review tools for reviewing each federal hatchery program and facility. The Team provides continuity with the HSRG because the two co-chairs served on the HSRG and the Hatchery Reform Policy Coordinating Committee, respectively. The Service has contracted for project facilitation with Long Live the Kings (LLTK), a non-profit organization devoted to restoring wild salmon to the waters of the Pacific Northwest. LLTK has provided facilitation, communications and coordination for the Puget Sound and coastal Washington hatchery review process.

Review Team members for the review presented here include:

- **Don Campton** (Co-Chair), Senior Scientist, USFWS, Abernathy Fish Technology Center, Longview, Washington.
- **Douglas DeHart** (Co-Chair), Fish Biologist, Coffee Creek Bioscience, Oregon City, Oregon.
- **Tom Flagg**, Supervisory Fish Biologist, NOAA Fisheries, Manchester Research Station, Manchester, Washington.
- **Susan Gutenberger**, Supervisory Microbiologist, USFWS, Lower Columbia River Fish Health Center, Willard, Washington.
- **Joe Krakker**, Fishery Biologist, USFWS, Lower Snake River Compensation Plan Office, Boise, Idaho.
- **Bryan Kenworthy,** Project Leader and Manager**,** USFWS, Hagerman National Fish Hatchery, Hagerman, Idaho.
- **Larry Marchant**, Project Leader and Manager, USFWS, Spring Creek NFH, Underwood, Washington.
- **Doug Olson**, Hatchery Assessment Team Leader, USFWS, Columbia River Fisheries Program Office, Vancouver, Washington.
- **Chris Pasley**, Project Leader and Manager, USFWS, Winthrop NFH, Winthrop, Washington.
- **Herb Pollard,** Fish Biologist and Management Specialist, Independent Consultant.

Team support members include:

- **Michael Schmidt** (Facilitator), Director of Fish Programs, Long Live the Kings, Seattle, Washington.
- **Jed Moore,** Project Assistant, Long Live the Kings, Seattle, Washington.
- **Cheri Anderson** (Outreach), Information and Education Manager, USFWS, Spring Creek NFH, Underwood, Washington.

The Fisheries ARD has also appointed a Hatchery Oversight Team (Oversight Team), consisting of line supervisors with policy and managerial responsibilities, as the Service's primary internal mechanism to oversee the review process, monitor its progress, and transmit communications and reports from the Review Team to the ARD and project leaders within the Service's Pacific Region Fisheries Program. The Oversight Team, along with the ARD, will be the primary contact group between the Service and its partners for developing mechanisms and policies for implementing, or modifying, the Review Team's recommendations.

The review process began in October 2005 with the Warm Springs National Fish Hatchery (NFH). This hatchery is located on the Warm Springs River, in the Deschutes River watershed/Columbia Plateau province, in Oregon. This review was conducted as a pilot to help the Service test and refine the review process. Fishery comanagers and stakeholders were involved in the review process and asked to comment on draft reports and recommendations. The final report for Warm Springs NFH was released in May 2006 (available at www.fws.gov/Pacific/fisheries/hatcheryreview/reports.html).

Following this pilot review, the Service adjusted the process for reviewing federal hatcheries that support artificial propagation programs for four regions: Lower Columbia River, Mid-Columbia River, Snake River, and the Olympic Peninsula (Fig. 1). Facilities in those regions include five NFHs in the Lower Columbia River region (Eagle Creek, Carson, Little White Salmon, Willard and Spring Creek NFHs); three NFHs in the Mid-Columbia River region (Leavenworth, Entiat and Winthrop NFHs); three NFHs in the Snake River region: (Dworshak, Kooskia and Hagerman NFHs), three NFHs in the Olympic Peninsula region (Makah, Quilcene, and Quinault NFHs), and nine federally-owned hatcheries operated by the states of Idaho, Oregon, or Washington as part of the Lower Snake River Compensation Plan (LSRCP).

The report presented here reviews hatchery programs of the LSRCP in Washington State: Lyons Ferry Fish Hatchery (FH), Tucannon FH, and satellite facilities in southeast Washington (Fig. 2).

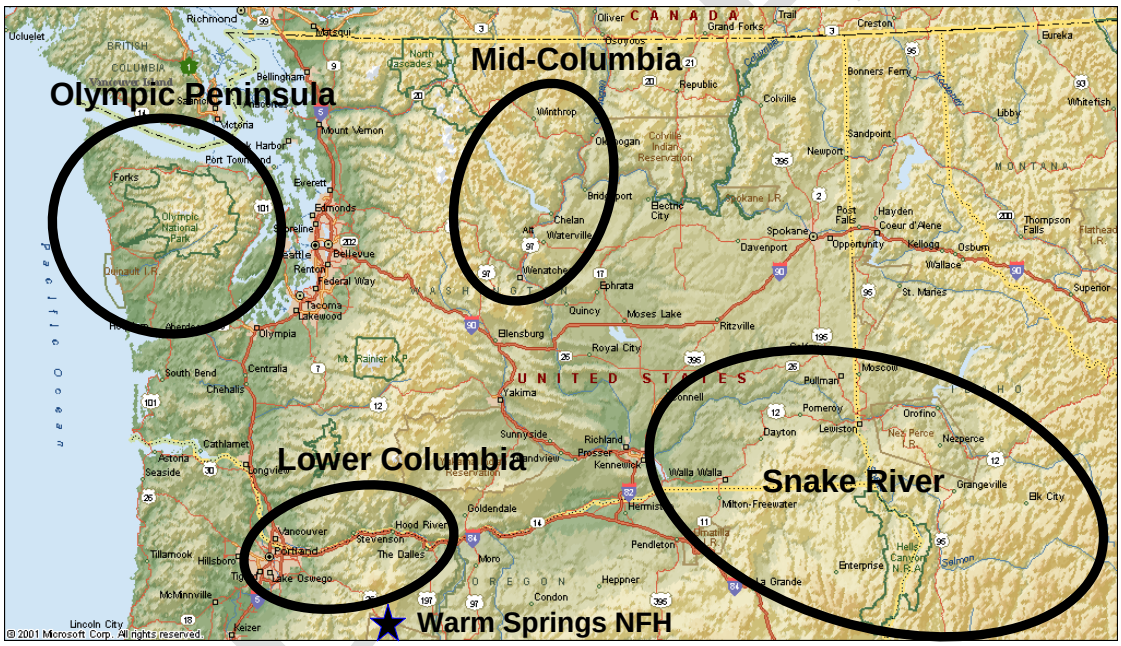

Figure 1. Regions of the Pacific Region Hatchery Review Project

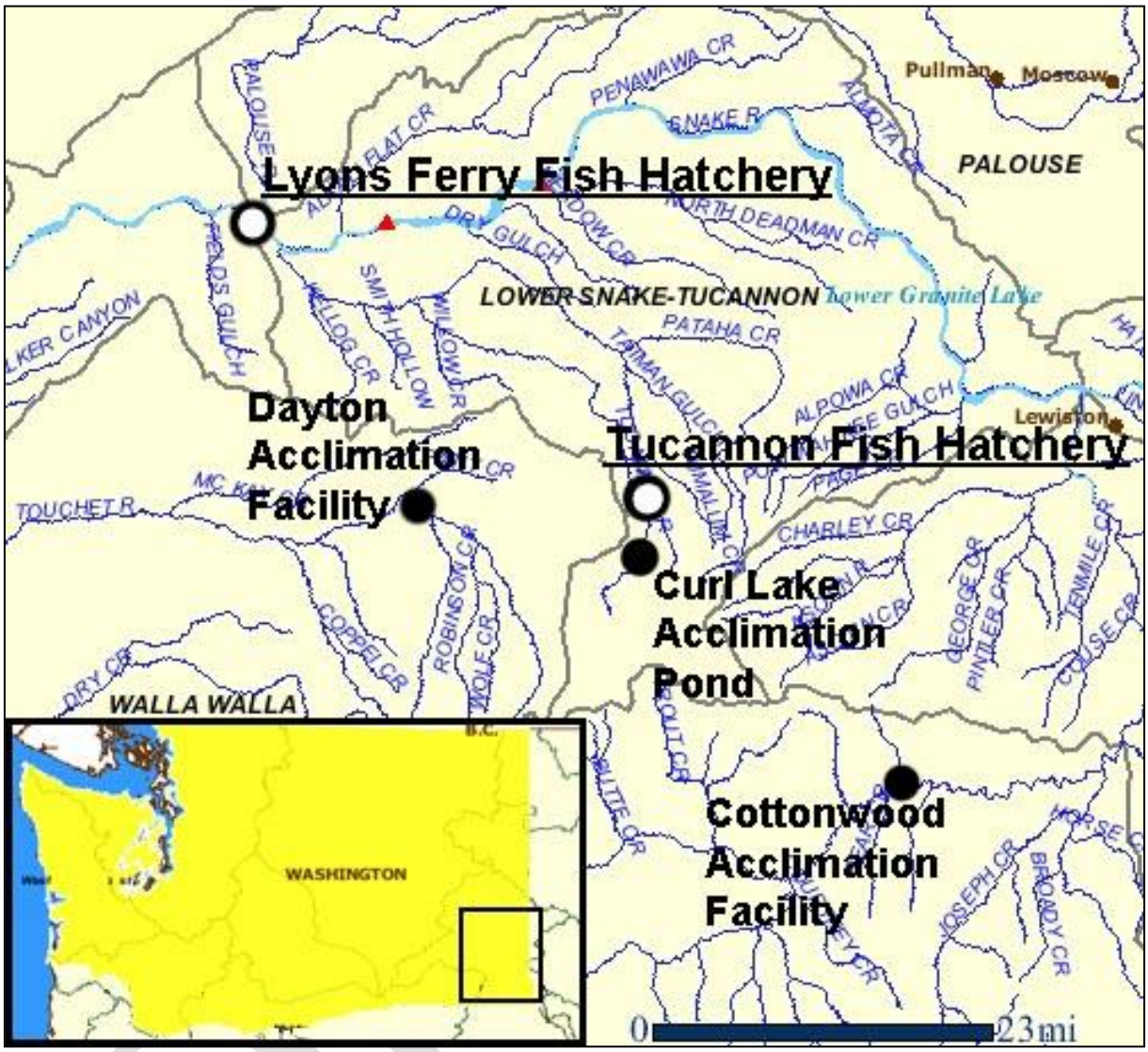

Figure 2. Washington Lower Snake River Compensation Plan hatcheries reviewed in this report.[13]

Those programs release fish into the lower Snake River mainstem at Lyons Ferry FH, and the Tucannon, Touchet, Walla Walla and lower Grande Ronde rivers of Washington. The Service completed its review of all the National Fish Hatcheries in July 2009 and plans to complete reviews and finalized reports for all federally owned facilities in the Snake River region by June 2010.

[13] *Modified figure from: Streamnet. <http://map.streamnet.org/website/snetmapper/viewer.htm>*

II. Components of this Report

This report provides assessments and recommendations developed from a comprehensive review of current propagation programs at Lyons Ferry FH, Tucannon FH, and their satellite juvenile acclimation and adult recapture facilities operated by the Washington Department of Fish and Wildlife (WDFW). Recommendations presented herein are based on the best scientific information available at the time of the review. This information includes peer-reviewed scientific information in published works (scientific journals, etc.), agency reports, and pertinent information directly accessible via electronic download. In its review, the Team followed three fundamental principles it adopted from the HSRG (Mobrand et al. 2005[14]): (1) hatchery programs need to have well-defined goals in terms of desired benefits; (2) hatchery programs and protocols must be scientifically defensible; and (3) hatchery programs need to monitor and evaluate their benefits and risks with programmatic flexibility to respond adaptively to new information.

The Review Team reviewed a large number of background documents, toured the two LSRCP state operated fish hatcheries, their satellite facilities, and local habitat features, and received presentations on a variety of Grande Ronde, Lower Snake Mainstem, Tucannon, Touchet, and Walla Walla River watershed salmonid management issues. The Team then met with biologists representing the comanagers and stakeholders to discuss the purpose of the review, hatchery operations, stock goals, and specific issues the comanagers and stakeholders wanted the Review Team to consider. Workshops for gathering that information used the recently-developed All-H Analyzer (AHA) decision support tool[15] to document goals, premises and explore alternatives (Appendix A). All source documents not readily available to the general public are accessible via the Service's hatchery review website[16]. Appendix B of this report summarizes background information and operational details of the hatchery programs on which the review and recommendations are based.

Based on the information gathered, the Review Team assessed benefits and risks of each hatchery program relative to current or short-term (10-15 years) goals and then drafted a set of preliminary recommendations that would increase or maintain benefits while minimizing or reducing risks, respectively. The Team also examined possible program alternatives to address long-term (15-50 years or greater) conservation and/or harvest goals. The initial results of the review were presented orally to the comanagers. The Review Team then developed a draft report, circulated it to comanagers for initial comment and revision, and then posted it on the Team's website for one month for public comment. The Team also conducted a meeting with interested stakeholders (e.g., fishing guides, conservation groups, etc.) to receive verbal input. The final report presented here was prepared after written comments on the draft report were received from comanagers, interested stakeholders, and the general public. Review Team responses to those written comments are presented in Appendix C. The complete texts of all written comments received are compiled in Appendix D. A summary of the annual operating costs associated with each hatchery are presented in Appendix E.

Watershed Overview

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[14] *Mobrand, L., J. Barr, L. Blankenship, D.E. Campton, T.T.P. Evelyn, T.A. Flagg, C.V.W. Mahnken, L.W. Seeb, P.R. Seidel, and W.W. Smoker. 2005. Hatchery reform in Washington State: principles and emerging issues. Fisheries 30(6): 11-23.*

[15] *For more information on AHA, see* AHA Technical Discussion Paper *on the Publications page of www.hatcheryreform.org.*

[16] *www.fws.gov/Pacific/fisheries/hatcheryreview/*

The following report contains a background overview of the Washington portion of the Lower Snake River and tributaries, including the Grande Ronde, Tucannon, Touchet, and Walla Walla rivers. Although the Walla Walla River is not a tributary to the Snake River, it enters the Columbia River approximately 16 miles downstream from the Snake River and supports hatchery programs as part of the LSRCP for Washington. The overview includes information on geography, fisheries, conservation, habitat, and the current status of each salmonid stock within the watershed. Information on the status and hatchery propagation of each stock is summarized in a table for quick reference.

Stock Status

An understanding of the current status of each salmonid stock in each watershed was necessary for assessing the benefits and risks associated with each hatchery program. The Review Team summarized the current status of each stock in terms of four population parameters: *biological significance*, *viability*, *habitat*, and *harvest*. Each of those parameters was given a generalized rating of "high", "medium", or "low" as a foundation for assessing the benefits and risks of each hatchery program. The Review Team also needed to understand the short-term (10–15 years) and long-term (50 years or greater) goals for each salmonid stock within each watershed relative to the four population parameters. However, it was neither the mandate nor the responsibility of the Review Team to perform detailed, scientific assessments of population status. Instead, the Review Team relied on the consensus assessments of the comanagers: WDFW, National Oceanic and Atmospheric Administration/National Marine Fisheries Service (NOAA Fisheries), Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation (CTUIR), and our own Service biologists. The Review Team also relied on the subbasin plans of the Northwest Power and Conservation Council (NWPCC)[17] and reports of the Interior Columbia Technical Recovery Team (IC-TRT).[18] Working definitions for each of the four population parameters are provided below.

Biological significance is a measure of the biological uniqueness of a particular stock or population relative to other stocks of the same species. This measure considers the genetic origins of the stock (e.g. native or non-native), biological attributes that are unique or shared with other stocks (e.g. life history, physiological, or genetic attributes), and the extent to which the stock may be considered one component of a larger population structure, including population subdivisions within the stock. In general, a stock is defined as *low*, *medium* or *high* biological significance depending on its level of uniqueness and the ability of other stocks to potentially replace it in the occupying habitat if local extirpation were to occur. Stocks with *high* biological significance usually have one or more unique biological characteristics that may reflect local adaptations and would be difficult to replace by other stocks of the same species. Consequently, biological significance is not based on the degree to which the stock may be considered essential for harvest or recovery of a particular species, but rather on its own innate biological attributes within the watershed in which the stock occurs. For example, a particular stock or population may be abundant and productive and, therefore, considered to have high *management* significance for harvest or recovery. However, that stock would not necessarily be considered to have high *biological* significance unless (a) it possessed biological attributes not shared by other stocks of the same species or (b) all other stocks within the region or DPS/ESU[19] were substantially less viable. This approach thus distinguishes the *evolutionary legacy* of a stock within a particular watershed from co-manager decisions regarding the potential *management value* of that

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[17] *http://www.nwcouncil.org/fw/subbasinplanning/Default.htm*

[18] *http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Index.cfm*

[19] *Distinct Population Segment (DPS) and Evolutionarily Significant Unit (ESU). ESU is NOAA Fisheries' definition for a Distinct Population Segment (DPS) of Pacific Salmon under the U.S. Endangered Species Act. NOAA Fisheries has retained DPS designations for steelhead.*

stock. In this context, *biological significance* ratings are based on the factors described by Mobrand et al. (2005)[20].

Population viability measures the ability of a stock to sustain itself under current environmental conditions. NOAA Fisheries has assembled *Technical Recovery Teams* (TRT) to assess viabilities and develop recovery criteria for ESA-listed salmon and steelhead populations throughout the Pacific Northwest. Those assessments involve significant mathematical modeling and attempt to predict extinction probabilities over the next 100 years based on four viability parameters: abundance, productivity, spatial structure, and diversity.[21] Preliminary viability estimates for listed salmonid stocks in the Snake River region have been compiled by the Interior Columbia TRT (ICTRT)[22]. Where available, the Review Team relied on those viability estimates, as developed by the ICTRT; otherwise, the Review Team relied on the viability criteria of Mobrand et al. (2005)[23]. The goal here was to establish a qualitative understanding of the current viability of each salmonid stock potentially affected by each Service hatchery program as a foundation for assessing potential benefits and risks of those programs. However, estimating the viability of a natural population, including *integrated* hatchery stocks, is difficult because those estimations require detailed evaluations of natural reproductive output and enumeration of natural-origin adult returns over multiple generations. In contrast, the viability of *segregated* hatchery stocks is relatively simple and is determined primarily by the number of hatchery-origin adult recruits (R) recaptured in fisheries, the hatchery, or other areas per adult spawner (S) in the hatchery one generation earlier (R/S).

Habitat conditions for a particular stock are assessed quantitatively through estimates of the *capacity* and *productivity* of the environment under current conditions to support returning adult spawners and juvenile fish (assessed via spawner-recruit models). In this context, premises regarding habitat refer primarily to natural populations and the specific watersheds in which hatcheries are located. These premises are important for assessing the ability of the local habitat and watershed to support self-sustaining natural populations and genetically *integrated* hatchery broodstocks, including assessment of risks posed by hatchery-origin fish spawning naturally. The productivity and capacity of a watershed are difficult to estimate directly, but the *Ecosystem Diagnosis and Treatment* (EDT) model attempts to predict those parameters for a "focal species" based on empirical estimates of a variety of habitat parameters (www.mobrand.com/MBI/edt.html). Where available, the Review Team relied on HSRG (2009) estimates of current and future habitat conditions (productivity and capacity) for each salmonid stock in the pertinent watersheds associated with a Service hatchery.[24] Habitat and capacity parameters can also be adjusted iteratively in spawner-recruit population dynamic models to yield results that best fit empirical estimates of total adult returns and/or smolt output under current conditions (Appendix A). This latter approach allows cooperators and others to evaluate potential alternative strategies for improving long-term population viabilities via habitat enhancements or other management actions.

Harvest on salmonid fishes occurs at different locations and times and can be assessed by the mean number of adult fish harvested annually in mixed stock ocean fisheries, mainstem Columbia River

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[20] Mobrand, L., et al. 2005. Hatchery reform in Washington State: principles and emerging issues. Fisheries 30(6): 11-23.

[21] McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmon populations and the recovery of evolutionary significant units. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-42, Seattle, WA 156pp. Also see www.nwfsc.noaa.gov/trt/trt_Columbia.htm

[22] NEED CITATION…

[23] Mobrand, L., et al. 2005. Hatchery reform in Washington State: principles and emerging issues. Fisheries 30(6): 11-23.

[24] Hatchery Scientific Review Group (HSRG). 2009. Population Reports, Appendix E, Columbia River Systemwide Report. Available at: www.hatcheryreform.us/.

fisheries, and/or terminal fisheries within the particular sub-basin or watershed under consideration (Appendix A). Harvest parameters can be adjusted in a manner analogous to adjusting habitat parameters (as described above) to identify levels of harvest that are sustainable under a particular set of habitat conditions as measured by productivity and capacity.

Hatchery Programs

Hatchery programs are associated with many salmonid stocks. In general, all hatchery programs can be classified according to their type and purpose. Hatchery programs are classified (1) as either *integrated* or *segregated* according to the genetic management goals for the broodstock and (2) according to the purpose of the program with respect to intended benefits (e.g., harvest, conservation, research, etc.).

A hatchery program (or broodstock) is classified as *integrated* if natural-origin fish are purposefully included in the broodstock each year, or the intent of the program is to purposefully include natural-origin fish in the broodstock, with the goal that the natural environment will primarily determine the genetic constitution of hatchery-origin fish. The integrated strategy manages hatchery and wild fish as one population (or one gene pool) that spawns in two different environments but recognizes that the phenotypic performances of hatchery and wild fish can be quite different even when the two components are genetically the same. A properly integrated broodstock requires proportion of a broodstock composed of natural-origin fish (symbolized by "*pNOB*") exceed the proportion of natural spawners composed of hatchery-origin fish (*pHOS*).

A hatchery population is defined as *segregated* if it is propagated as a "closed" population where only hatchery-origin fish are used, or are intended to be used, for broodstock. *Segregated* programs or broodstocks are intended to maintain the hatchery population as a distinct, genetically-segregated population via the exclusive use of hatchery-origin adults for broodstock.

The segregated and integrated strategies yield very different broodstock goals and propagation protocols. The segregated strategy creates a hatchery-adapted population that can facilitate management goals (e.g. harvest) but which can also increase genetic and ecological risks to natural populations. In contrast, the integrated strategy attempts to increase the abundance of fish representing an existing natural population or gene pool.

Hatchery programs need to be defined also in terms of their intended benefits. The primary purpose of most hatchery programs is to achieve *harvest* or *conservation* benefits, or both. Secondary purposes can include conservation or harvest, but often include education, research, socioeconomic or cultural/ceremonial benefits. These purposes should be closely linked to the goals of hatchery programs. Although *mitigation* is often stated as a "purpose" of a hatchery program, mitigation typically refers to the replacement of wild fish with hatchery fish without defining specific goals in terms of desired benefits (e.g., *mitigate* for fish losses associated with hydropower dams).

Operational Considerations

The Review Team considered all components of each hatchery program. Major features and issues of each program were summarized into the following subcategories: (a) program goals and objectives; (b) broodstock choice and collection; (c) hatchery and natural spawning, including adult returns; (d) incubation and rearing; (e) release and outmigration; (f) facilities and operations; (g) research, monitoring, and accountability, and (h) education and outreach.

Benefit and Risk Assessment

In conducting this review, the Review Team considered a wide range of possible benefits and risks potentially conferred and imposed, respectively, by hatchery programs.

Benefits considered include:

- Contributions to tribal and non-tribal harvests (commercial and recreational).
- Short- and long-term conservation benefits (both demographic and genetic).
- Research opportunities afforded by the program.
- Educational, cultural, ceremonial and socioeconomic benefits conferred by the program and the hatchery facility itself.

Risks considered include:

Genetic Risks

- Risks from artificial propagation on the genetic constitution and fitness of hatchery-origin fish representing the cultured stock.
- Risks from natural spawning by hatchery-origin adults on the mean fitness of natural-origin fish of the same species in target and non-target watersheds.

Demographic Risks

- Pre-release risks from the hatchery facility and operations on the abundance of the propagated stock including the following: pre-spawning mortality associated with trapping, holding and/or bypassing adults; disease risks associated with overcrowding or high rearing densities of cultured fish; inadequate fish health protocols and water flow alarms to prevent catastrophic fish losses in the hatchery; poaching by humans; and predation by birds, mammals and fish at the point of release or on the hatchery grounds (e.g. by otters and birds).
- Post-release risks to the abundance of the propagated stock, including congregation of released fish at the release point and/or unnatural surface feeding (conditioned by hatchery rearing) that may increase vulnerability of released fish to predators, thus decreasing smolt-to-adult survival.
- Demographic risks from hatchery operations on the abundance of other stocks and species within the watershed in which the hatchery is located (e.g. effects of a barrier weir for trapping adults for hatchery broodstock).

Ecological Risks

- Competition, predation, and disease transfer from hatchery-origin adults and juveniles of the propagated stock to naturally spawning populations of the same species or stock in target and non-target watersheds.
- Competition, predation, and disease transfer from hatchery-origin adults and juveniles of the propagated stock to naturally spawning populations of different species in target and non-target watersheds, including non-salmonid fish species of particular concern (e.g. lamprey).

- Risks from the hatchery facility and operations on the aquatic biota and ecosystem within the target watershed, including the effects of hatchery effluent, water intake, use of chemicals, and upstream/downstream passage of fish and other aquatic species in the watershed.
- Risk of antibiotic use resulting in developing resistant strains of pathogenic organisms that infect salmonid fishes, other aquatic species, and humans.
- Producing fish that are not qualitatively similar to natural fish of the same species in size, growth rate, morphology, behavior, physiological status or health, which may adversely affect the performance of natural fish via competition or predation.
- The Team recognizes that hatchery-origin juveniles and adults may ecologically impact other fish species and populations in the estuary and ocean environment; however, little information on these *cumulative effects* is currently available.

Physical Risks

- Risks from the hatchery facility and operations to human health and safety, including potential contaminants.

The Team evaluated the benefits and risks of all operational and physical components of each hatchery program. These components are the same as those outlined above under *Operational Considerations.* Those evaluations then formed the bases of the Team's recommendations.

Recommendations

After careful assessment of the benefits and risks conferred by a hatchery program, the Review Team developed a series of recommendations to increase the likelihood of achieving the desired goals and benefits of the program and/or reducing biological and other risks. Recommendations for the current hatchery programs are grouped into the same categories as listed above under *Operational Considerations*. Recommendations for current programs are intended to address short-term goals and needs.

Alternatives

The review team then identified several alternatives to the current program, as suggested by comanagers or inferred from long term goals for salmonid stocks within the region, with an overall assessment of the value and merits (pros and cons) of those potential alternatives relative to the current program. By default, the following alternatives were included in each assessment: (a) the current program with full implementation of all recommendations and (b) termination of the current program and decommission of the hatchery in favor of alternative mitigation strategies (e.g., habitat restoration, construction of a new hatchery elsewhere, etc). The Team then selected a recommended alternative, or combination of alternatives, that the Team concluded would provide the greatest benefit-risk ratio in support of long-term harvest and conservation goals.

III. Washington Lower Snake River Basin

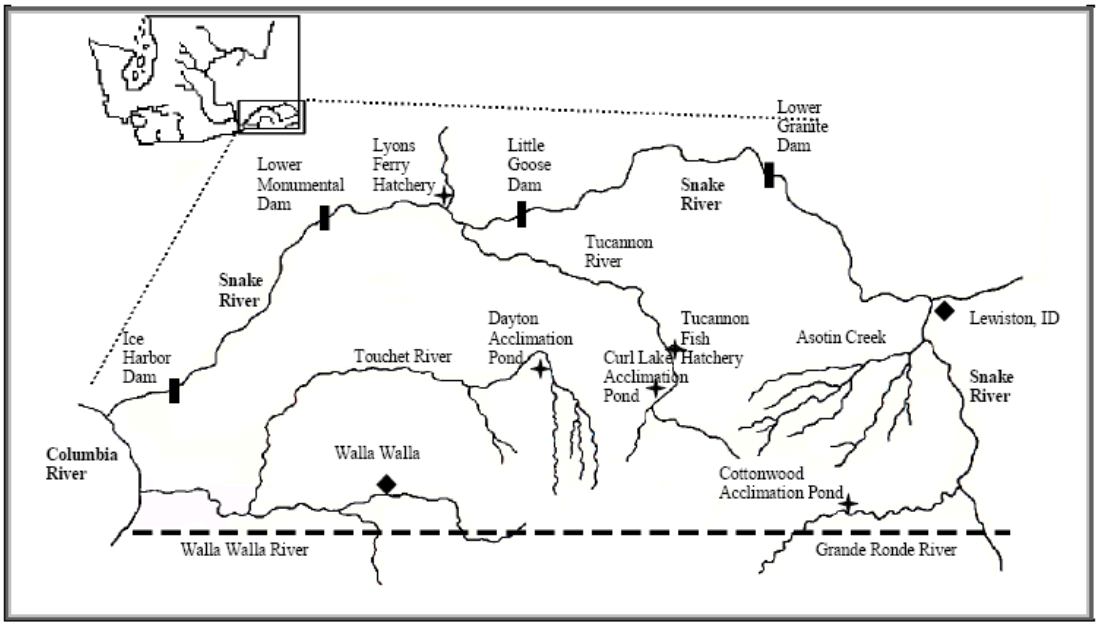

Figure 3. Map of the Lower Snake River Compensation Plan (LSRCP) Lyons Ferry Complex facilities, and major rivers and streams in Southeast Washington [25]

[25] *WDFW, 2008. Lyons Ferry Complex. Annual Operating Report October 1 2007 through September 30, 2008. WDFW Lyons Ferry Complex and Snake River Lab staff.*

Washington LSRCP Overview

Watershed Description

The geographic regions addressed in this report include the mainstem Snake River and tributaries within the state boundaries of Washington upstream from the confluence of the Snake and Columbia rivers near Pasco, Washington (Fig. 3 on preceding page). This geographic region also includes the Walla Walla River which enters the Columbia River approximately 16 miles downstream from the Snake River. Major tributaries to this region of the Snake River include the Palouse, Tucannon Clearwater, and Grande Ronde rivers. The Palouse River enters the north side of the Snake River near the Tucannon River but does not support anadromous fish populations because of a large, natural barrier falls (Palouse Falls) immediately upstream from the Snake River. Smaller tributaries supporting salmon and/or steelhead include Asotin and Alpowa creeks.

The Snake River drainage of southeast Washington area is bounded by the Columbia River to the west, the Snake River canyon to the north and east, and the Oregon-Washington state line to the south. The Blue Mountains lie along the state boundary and are a major geological feature of the area. Terrain varies from low elevation agricultural land in the lower river valleys to over 6,000 foot elevations in the Blue Mountains. The Snake River Basin has a total drainage area of approximately 108,700 square miles from its headwaters in Wyoming to the confluence with the Columbia River. Only about five percent of this area occurs in Washington.

Reservoirs behind four mainstem hydropower dams flood 140 of 175 miles of the main Snake River Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams. These dams were constructed by the U.S. Army Corps of Engineers in the 1960s and 1970s for hydropower and navigation. Lake Wallula behind McNary Dam on the Columbia River floods the lower five miles of the Snake River. Only 30 miles of the Snake River within Washington, from the town of Asotin upstream to the state border with Oregon, is free flowing.

Tucannon River

The Tucannon River originates in the Tucannon-Wenaha Wilderness near the Oregon border and flows northward 70 miles and flows into the Snake River at river mile (RM) 62.2, three miles upstream of Lyons Ferry State Park, near the mouth of the Palouse River. There are two major drainages in the Tucannon subbasin; the main stem drains 318 square miles. Pataha Creek drains an additional 190 square miles, but has been severely impacted by land use and does not support significant fishery resources. The Palouse River is blocked by a natural barrier falls and does not support anadromous fish.

Grande Ronde River

The Grande Ronde River flows generally northeast 212 miles from its origin in the Wallowa and Blue Mountains in Oregon. The Grande Ronde crosses into Washington at RM 38.7 before joining the Snake River at river mile (RM) 169, about 20 miles upstream of Asotin, Washington and 493 miles from the mouth of the Columbia River. The Grande Ronde subbasin drains 3600 square miles in the extreme northeast corner of Oregon as well as 341 square miles in the extreme southeast corner of Washington.

Walla Walla River

Walla Walla River and its tributaries originate in the Blue Mountains of southeastern Washington and northeastern Oregon and flow north and west to enter the Columbia River at Lake Wallula behind McNary Dam. About 73 percent of the 1,758 square miles drainage lies in Washington. Elevations in the subbasin range from about 6,000 feet at mountain crests to only 300 feet at the Columbia River. The eastern portion of the drainage lies in steep, timbered slopes of the Blue Mountains within the Umatilla National Forest. The remainder of the drainage consists of middle elevation rolling hills of the Palouse and level terrain in valleys. The Touchet River is the main tributary of the Walla Walla River.

Regional climate

The climate of the southeast Washington watersheds is largely determined by the Cascade Mountains to the west and prevailing westerly winds from the Pacific Ocean. Maritime air masses are intercepted by the Cascade Mountain range, creating a rain shadow which contributes to the arid steppe of the Columbia River basin between the Cascade Mountains to the west and the Blue Mountains to the east.

Elevation is another major factor affecting the climate and weather patterns in southeast Washington watersheds. Landscapes vary from warm and semiarid in the western and lower river valleys to cool and relatively wet in the higher elevations of the Blue Mountains. Precipitation across the southeast Washington subbasins falls mainly in the winter, with 64% of the total annual precipitation occurring from October through March. Precipitation falls primarily as rain in the lower elevations and snow in the higher elevations. Temperatures exhibit a large seasonal variation with maximum daily temperatures greater than 38°C (100°F) in summer and minimum temperatures less than –18°C (0°F) in winter.

Fisheries

Tribal and recreational fisheries for salmon and steelhead in southeastern Washington are supported primarily by hatchery programs based at federally-owned Lyons Ferry FH, Tucannon FH, and associated satellite facilities used for releasing juveniles and/or trapping adults and/or releasing juveniles. Fisheries on salmon and steelhead in southeast Washington also intercept anadromous fish migrating upstream through the lower Snake River toward several release points and hatcheries in Idaho and Oregon. The current threatened status of natural populations of steelhead and Chinook salmon in southeast Washington preclude significant fisheries on natural populations (see *Conservation* section below).

Fall Chinook

Fisheries on fall Chinook in the lower Snake River have been severely limited by the ESA status of natural populations (see below). Opportunity for harvest in tribal and recreational fisheries has been limited by conservation concerns while the Lyons Ferry program has developed. However, some hatchery fish in excess of conservation needs have returned in the recent years and limited harvest, mostly incidental to the popular steelhead fishery, has been allowed. Fall Chinook salmon, including fish from Lyons Ferry Hatchery; continue to provide important fisheries in the ocean and Columbia River. In 2008 Idaho, Washington, and the Nez Perce Tribe opened fall Chinook fisheries in the Snake River. Idaho anglers caught an estimated 132 marked adult and jack fall Chinook on the Snake River between Lewiston and Hells Canyon Dam (Oct 3 through Oct 31, 2008), Washington anglers caught an estimated 9 fall Chinook on the Snake River between just below the mouth of the Tucannon River and approximately one mile above Little Goose Dam (Sept. 25 through Oct. 15), and the Nez Perce Tribe harvested an estimated 52 fall Chinook in the Clearwater River.

Spring/summer Chinook

The main Snake River is the migration corridor for numerous populations of listed, naturally produced spring and summer Chinook. Fisheries are usually constrained by conservation concerns for impacts to the listed, wild populations in a mixed-stock harvest. However, opportunity to harvest non-listed hatchery-origin spring/summer Chinook in excess of conservation needs has occurred since 2000.

Steelhead

Hatchery–origin steelhead returning to the local facilities as well as to upstream hatchery programs support heavily utilized fisheries in the southeastern Washington area. Steelhead returning to the hatchery facilities and concentrating near dam tailraces and pools and at the confluences of the Clearwater and Grande Ronde rivers with the Snake provide high catch rates and attract popular fisheries. Harvest varies annually depending on returning fish numbers and environmental conditions. Between 1995 and 2002 steelhead harvest ranged from 4.000 to 11,000 in the Snake River and 1,500 to 5,400 in the Grande Ronde River.

Estimates of annual steelhead harvest in tribal and recreational fisheries (WDFW)

	1995-96	**1996-97**	**1997-98**	**1998-99**	**1999-00**	**2000-01**	**2001-02**
Main Snake - WDFW	5,580	5,144	6,757	4,053	5,243	8,114	10,979
Grand Ronde - WDFW	2,913	3,412	4,597	1,470	2,064	5,390	7,725

Resident Trout

Resident rainbow/redband and bull trout provide limited recreational fisheries in headwater streams. Harvest of bull trout in recreational fisheries is prohibited and harvest of resident rainbow/redband trout is limited to two fish per day over eight inches minimum total length. Hatchery-reared trout released in ponds and lakes provide a popular fishing opportunity in lowland areas and residual steelhead smolts are harvested as trout in the Snake River reservoirs. Hatchery-origin rainbow trout are stocked in ponds as partial mitigation for the lower Snake River dams.

Other species

Introduced populations of warm-water game fish including smallmouth and largemouth bass, crappie, bluegill sunfish and several species of catfish in the warm slack water of the Snake River reservoirs support popular fisheries during the warmer months when anadromous fish are not available. Recreational fishing for white sturgeon is permitted on a catch-and-release basis only.

Conservation

Several species and races of anadromous fish are native to southeastern Washington, but habitat losses have greatly reduced numbers and distribution, and extirpated some populations. Coho were considered extinct in the Snake River in 1986. Spring/summer and fall Chinook, steelhead, and bull trout in the Snake River and tributaries are all listed as *threatened* species under the U.S. Endangered Species Act. White sturgeon and lamprey are greatly reduced from historical abundance.

Fall Chinook

Populations of fall Chinook occurred historically upstream from Hells Canyon but their upstream migration was blocked and the populations extirpated after construction of the Hells Canyon Hydroelectric Complex (Hells Canyon, Oxbow, and Brownlee Dams) by Idaho Power Company between 1958 and 1968. Spawning areas in the Washington reach were inundated by the Lower Snake River dams. The remaining Snake River fall Chinook were restricted to the free flowing river between the backwaters of Lower Granite Reservoir and Hells Canyon Dam, which is estimated to be less than 15% of the formerly occupied habitat. The presently existing natural spawning population of fall Chinook in the lower Snake River represents the remnant Snake River stock, enhanced by recent hatchery supplementation efforts. Fall Chinook salmon upstream of Lower Granite Dam are considered part of a single genetically similar aggregate and are designated by NOAA Fisheries as one evolutionarily significant unit (*Snake River Fall Chinook Salmon ESU*).

The Lyons Ferry FH fall Chinook program was initiated as an "egg bank" in 1982, based on collection of adult Chinook from fish ladders in the Snake River dams. When the remnant natural population dwindled to fewer than 100 fish spawning in the Hells Canyon reach of the Snake River in the early 1990s, most of the genetic heritage of this ESU was considered to persist in the hatchery stock (1992 NMFS Status Report). Improved smolt-to-adult survival and expansion of the hatchery program into supplementing natural spawners in the Snake and Clearwater rivers has apparently contributed to large numerical and distribution increases in the population. Degraded habitat and straying of out-of-basin fish remain as important conservation concerns.

Spring/summer Chinook

Native populations of spring /summer Chinook in the Walla Walla River and Asotin Creek were extirpated by habitat and environmental factors in the last century. The indigenous spring Chinook population of the Tucannon River persists and is the focus of a conservation hatchery program operated at Lyons Ferry and Tucannon FHs. A few pairs of spawning Chinook, of unknown origin have been observed in Asotin Creek in recent years, and the CTUIR fisheries department is experimentally reintroducing spring Chinook to the Walla Walla River using out-of-basin stocks.

Coho salmon

Coho salmon were declared extinct from the Snake River in 1986. Coho may have been native to the Walla Walla and Tucannon Rivers. Natural spawning of coho salmon in the Snake River basin (i.e., before current reintroduction efforts were initiated) was last reported in spring-fed tributaries of the Wallowa River, tributary to the Grande Ronde River. This stock of coho was considered biologically unique in terms of the migration distance and elevation of spawning habitat within the range of the species.

The Nez Perce Tribe, in collaboration with the U.S. Fish & Wildlife Service, is currently attempting to reintroduce coho salmon in the Clearwater River utilizing lower Columbia River stocks. Coho thought to be strays from the Clearwater River have been observed in the lower Tucannon River. Tribal co-managers are interested in reintroducing coho into suitable habitat in southeast Washington if the Clearwater River reintroduction effort is successful.

Steelhead

Steelhead in the Snake River Basin are often classified as two life history forms, commonly referred to as "A-run" and "B-run" steelhead (Kiefer et al. 199226). B-run steelhead generally return later in the

[26] *Kiefer et al. 1992. Full citation needed.*

year and at a larger mean size and older mean age than A-run steelhead. Both A-run and B-run steelhead trout exist in the southeastern Washington and are included in the Snake River Steelhead ESU. The indigenous steelhead that spawn in tributaries of the lower Snake River and Walla Walla system are considered to be A-run steelhead. B-run steelhead spawn in the Clearwater and Salmon rivers and only occupy the main Snake River as a migration corridor. Natural populations of steelhead in the southeastern Washington drainages are currently classified as threatened. Hatchery-origin steelhead representing the endemic populations in the Touchet and Tucannon rivers are included with the Snake River Summer Steelhead ESU and ESA listing.

Bull trout

Bull trout are present in the Tucannon River, the Walla Walla River, and the Grande Ronde River and occasionally in the Snake River near the confluence of the Grande Ronde River. Although bull trout are widely distributed in southeastern Washington drainages, the populations are primarily limited to cooler headwater streams. Historical connectivity between those populations is now blocked by physical and thermal barriers. Isolation of small populations in fragmented habitat is a conservation concern for this species.

Pacific Lamprey

Pacific lamprey are considered an endangered species by the state of Idaho (IDFG 2001c), but are not listed under the U.S. ESA. Throughout their range in the Columbia River Basin, Pacific lampreys have declined to only a remnant of their pre-1940s populations. Counts of upstream migrating Pacific lamprey at lower Snake River dams were over 30,000 fish in the late 1960s but have declined to less than 500 fish in recent years. Currently, an estimated 3% of the lamprey that pass Bonneville Dam are counted at Lower Granite Dam (Close 2000). As a result, the abundance of Pacific lamprey in the southeastern Washington subbasins is thought to be extremely depressed (CBFWA 1999). Identified threats to Pacific lamprey in southeastern Washington include the effects of the hydropower dams on the Snake and Columbia Rivers, stream alterations, and amnocoet harvest by bait fishermen.[27] Because Pacific lamprey spend extended periods in freshwater, they are especially vulnerable to degraded stream conditions, including sedimentation due to land disturbance and water quality limitations that impact diatom (food) production in nursery streams (Paradis et al. 1999b).

Other species

Other species of conservation interest include inland redband/rainbow trout, mountain whitefish, and white sturgeon. Resident trout and mountain whitefish have been affected by many of the same habitat and anthropogenic factors that have affected the abundance of anadromous salmonids and are expected to benefit from recovery actions directed at salmon and steelhead in the Snake River basin.

White sturgeon is a large, long-lived species that depends on large, free-flowing rivers to complete their life cycle. Sturgeon populations of the Snake River are now limited to a few free-flowing sections like the Hells Canyon reach. Sturgeon habitat has been fragmented by dams and connectivity between the Snake River and Columbia River populations has been blocked. Although a naturally reproducing population persists in the Snake River and individual sturgeon are occasionally observed in the reservoirs and tailraces of the Snake River Dams, habitat fragmentation and migration barriers remain a conservation concern.

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[27] *Status review by the Idaho Chapter of the American Fisheries Society (cited by Paradis et al. 1999b).*

Habitat

The abundance of salmon and steelhead in the southeastern Washington subbasins is limited by three primary factors: (1) marine survival and anthropogenic factors outside the area (e.g. dams, harvest); (2) reduced habitat carrying capacity and fish survival within the subbasins due to land management activities which affect hydrology, levels of sedimentation, and water quality; and (3) inundation of 80 percent of the Snake River by the backwater reservoirs behind the four dams on the lower Snake River. More than a century of agriculture in this region has contributed to sediment and high runoff in the streams. Water diversions for irrigation reduce instream flows, and irrigation return waters may be too warm and laden with sediment to support salmonid fishes. Extensive habitat improvement actions for the benefit of anadromous salmonids are either under way or being contemplated (see Northwest Planning and Conservation Council, Subbasin Plans). However, current habitat conditions in the lower sections of these rivers are not favorable.

Fall Chinook

Fall Chinook occupy the main Snake River and lower reaches of the Grande Ronde and the Tucannon rivers. Over 80% of the potential spawning habitat for fall Chinook in the lower Snake is inundated by the Snake River dams. Cold water and mid-winter floods reduce the suitability of the tributaries for fall-spawning stocks. Fall Chinook generally emigrate as subyearling smolts a few weeks after emerging from the gravel in the spring. However, a portion of the fall Chinook emerging from Snake River tributaries are now rearing in the reservoirs for one year before emigrating. This yearling life history appears to be evolving in response to the altered hydrology of the lower Snake River...

Spring Chinook

The remaining suitable habitat for spring Chinook in southeastern Washington is located in the upper reaches of the Walla Walla River, the Tucannon River and Asotin Creek. In each case, there is suitable spawning and rearing habitat in the headwaters, but land use and water flows limit the rearing capacity and may affect migration through the lower main stems. Spring Chinook return and spawn in the upper reaches and tributaries of the Grande Ronde River with the lower Grande Ronde and Snake rivers serving as migration corridors for downstream-migrating smolts and upstream-migrating adults when water flows and temperatures allow passage.

WDFW has assessed, for subbasin planning purposes, adult habitat capacities for spring Chinook in the Asotin, Tucannon, and Walla Walla subbasins based on the Ecosystem Diagnosis and Treatment (EDT) model (Power Planning and Conservation Council subbasin plans). The EDT model predicts the number of adult spawning fish that can be supported by the habitat under three scenarios: current conditions, "properly functioning conditions", and a "Reference" or historical maximum capacity (see Table below).

Predicted habitat capacities for adult spring Chinook derived from the EDT model. Current conditions account for reduced survivals imposed by the hydropower system. PFC and reference conditions refer to "properly functioning conditions" and historical maximum capacity, respectively.

Drainage	Current	PFC	Reference
Asotin Creek	158	1018	4348

Tucannon	506	2665	9317
Walla Walla	420	9318	17629

Coho salmon

Coho salmon are native to the Snake River, although their historical occurrence in specific tributaries is not well documented. Habitat factors similar to those that led to the extirpation of spring Chinook, overharvest in lower Columbia River mixed stock fisheries, are believed to have led to the extirpation of coho salmon in Snake River tributaries during the last half of the 20th century. Habitat actions designed to achieve recovery of steelhead and spring Chinook populations would also benefit coho in reintroduction programs.

Steelhead

Steelhead are able to utilize smaller headwater streams for spawning than spring Chinook, and the life cycle of the A-run steelhead that are indigenous to southeastern Washington allows them to use small and even intermittent streams. A-run steelhead of southeastern Washington migrate up the Columbia and Snake Rivers in late summer and early fall and overwinter in the main Snake and lower sections of the larger tributaries..In addition, summer-run steelhead in interior watersheds – particularly males – complete often complete their life cycles in their home stream and may reproduce before they smolt or outmigrate as kelts. As a result, steelhead are able to persist in habitats where some salmon species have been extirpated (e.g., Clearwater River).

For subbasin planning purposes steelhead habitats in the Asotin, Tucannon, and Walla Walla sub basins were assessed by the Washington Department of Fish and Wildlife using the Ecosystem Diagnosis and Treatment (EDT) method. The EDT model produces estimates of the number of adult spawning fish that might be supported by current habitat capacity, habitat under "properly functioning conditions" and a "Reference", or historical maximum capability. Results are summarized in the following table.

Predicted habitat capacities for adult steelhead derived from the EDT model. Current conditions account for reduced survivals imposed by the hydropower system. PFC and reference conditions refer to "properly functioning conditions" and historical maximum capacity, respectively.

Drainage	Current	PFC	Reference
Asotin Creek	206	358	8677
Tucannon	636	1213	12953
Walla Walla	1070	4159	16451

According to the EDT model, current steelhead habitat capacity is 25 to 60 percent of 'Properly functioning' and a much smaller fraction of historical potential.

Current Status of Salmonid Stocks

Fish Biologists associated with the LSRCP have identified 19 principal salmonid stocks, including two extirpated stocks of fall Chinook and one extirpated stock of spring/summer Chinook, in the Snake River Basin and adjacent regions of Oregon and Idaho potentially affected by LSRCP hatchery programs in Washington.

CHINOOK

Snake River Fall Chinook ESU

Snake River Fall Chinook MPG

- Lower Snake River mainstem fall Chinook (natural + integrated hatchery) [28]
- Marsing Reach Snake River fall Chinook (extirpated)
- Salmon Fall Snake River fall Chinook (extirpated)

Snake River Spring-Summer Chinook ESU

Lower Snake River Spring Summer Chinook MPG

- Tucannon River spring Chinook (natural + integrated hatchery)
- Asotin Creek spring Chinook (extirpated)

Mid-Columbia River Spring Chinook ESU

- Walla Walla spring Chinook (extirpated)

STEELHEAD

Mid-Columbia River Steelhead DPS

Walla Walla and Umatilla Rivers MPG

- Touchet River summer steelhead (natural + integrated hatchery) [29]
- Walla Walla summer steelhead (natural)

Snake River Steelhead DPS

Lower Snake River MPG

- Tucannon River summer steelhead (natural + integrated hatchery)[30]
- Asotin Creek summer steelhead (natural)

Grande Ronde River MPG

- Lower Grande Ronde River summer steelhead (natural)
- Joseph Creek summer steelhead (natural)

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[28] Broodstock collection occurs at Lyons Ferry FH and Lower Granite Dam, and subyearling and yearling releases occur in the Snake River at Lyons Ferry FH, Captain John Rapids and Pittsburg Landing acclimation ponds, and into the Clearwater River near Big Canyon Creek. Eggs are also transferred to the Umatilla and Oxbow hatcheries for releases into the Snake River and to Irrigon FH for releases into the Grande Ronde River.

[29] Broodstock collection and smolt release occur at Dayton Pond on the Touchet River. Rearing occurs at Lyons Ferry FH.

[30] Broodstock collection and smolt release occur at Tucannon FH on the Tucannon River. Rearing occurs at Lyons Ferry FH.

- Wallowa River summer steelhead (natural)
- Upper Grande Ronde River summer steelhead (natural)

Segregated Hatchery Steelhead Populations

- Lyons Ferry hatchery summer steelhead (segregated hatchery)[31]
- Cottonwood Creek hatchery summer steelhead (segregated hatchery) [32]
- Wallowa hatchery summer steelhead (segregated hatchery)
- Oxbow hatchery summer steelhead (segregated hatchery)

RESIDENT TROUT

- Lower Snake River rainbow trout (Tucannon River, Asotin Creek)
- Walla Walla and Touchet river rainbow trout
- Grande Ronde River rainbow trout
- Lower Snake River bull trout (Tucannon, Touchet, Grande Ronde, Asotin, Walla Walla rivers and Asotin Creek)

The following tables summarize the current status and management premises of these salmonid stocks. The principal sources of information for these tables were the1996 and 1998 NOAA-Fisheries status reviews of west coast steelhead and Chinook salmon populations, respectively[33]; Sub-Basin Plans of the Northwest Power and Conservation Council[34]; and the Snake River Salmon Recovery Plan for SE Washington[35] Additional information was obtained from Hatchery and Genetic Management Plans (HGMPs), WDFW research progress reports, WDFW Salmonid Stock Inventory (SaSI), and various documents produced by the Interior Columbia Technical Recovery Team (ICTRT)[36].

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[31] *Broodstock collection occurs at Lyons Ferry FH. Smolts are acclimated and released into the Snake River from Lyons Ferry FH, the Touchet River from Dayton Pond, and direct-stream released into the Walla Walla and Tucannon rivers.*
[32] *Broodstock collection and smolt release occur at Cottonwood Pond on the Grande Ronde River. Rearing occurs at Lyons Ferry FH.*
[33] *http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/*
[34] *http://www.nwcouncil.org/fw/subbasinplanning/Default.htm*
[35] *http://www.snakeriverboard.org/resources/library.htm*
[36] *www.nwfsc.noaa.gov/trt/*

Table 1. Lower Snake River mainstem fall Chinook (Lyons Ferry FH and satellite facilities)

Management Premises and Goals	
ESA Status	*Threatened* (1992).
Biological Significance	*High.* Interior TRT identified a single population with five major spawning areas. The Snake River population has distinct patterns of allelic diversity, differentiated from upper and lower Columbia River.
Population Viability	*Low to Medium.* Current numbers of natural-origin Snake River fall Chinook salmon have increased in recent years, with estimates at Lower Granite dam of 2,652 fish in 2001, 2,095 fish in 2002, and 3,895 fish in 2003. The natural-origin returns were as low as 78 adults in 1990. Interior TRT recommends minimum abundance threshold of 3,000 natural origin spawners, with no fewer than 2,500 natural origin spawners in the mainstem Snake River. Hatchery returns to the Snake basin have ranged from 1,800 to 18,000 for the years 1995 to 2005. Hatchery smolt to adult survival has been > 1% for release years after 1995, where prior to that it was often < 0.5% (Appendix B Tables 5 and 6 and Figure 8).
Habitat	*Low*. 20% or less of historical spawning and rearing habitat remains. Present habitat includes mainstem Snake River downstream of Hells Canyon Dam and the lower reaches of the Tucannon, Grande Ronde, Imnaha, Salmon, and Clearwater River subbasins.
Harvest	*Medium*. For yearling on-station release 33% of all coded-wire tag recoveries were in the ocean fisheries and 17% in Columbia River fisheries for release years 1989-1998 combined (Table 7 of HGMP). The Pacific Salmon Commission uses the subyearling release and recovery data from Lyons Ferry Hatchery as surrogate for wild fish. For the 2003-2006 catch years, total fishing mortality (ocean and freshwater combined) was estimated as 27.8% (Table E.72 of Pacific Salmon Commission Technical Report, December 2008). Within the Columbia/Snake rivers, harvest rate is abundance based where harvest ranges from 21.5% to 45% depending on expected upriver bright and Snake River natural returns to the mouth of the Columbia River (Table A.3 of 2008-2017 *U.S. v Oregon* Management Agreement). The last fishery in the Snake River was 1988 followed by a more recent limited opening in 2008 (see "Benefits" section of this report on fall Chinook).
Hatchery Program	
Facilities	Lyons Ferry FH (WDFW) and satellite facilities managed by the Nez Perce Tribe (Captain John, Pittsburgh Landing, Big Canyon). Eggs are also transferred to Umatilla, Oxbow and Irrigon hatcheries.
Type	Integrated
Authorization and Funding	LSRCP
Primary Purpose	Harvest

Secondary Purposes	Conservation
Broodstock Origin(s)	Snake River at Ice Harbor and Lower Granite dams.

Table 2. Tucannon River spring Chinook (Lyons Ferry FH and Tucannon FH)

Management Premises and Goals	
ESA Status	*Threatened*.
Biological Significance	*High*. The Tucannon River spring Chinook population is part of the Snake River spring/summer ESU which has 5 major population groupings. The Tucannon population is one of two historic populations in the lower Snake River. (the other historic population is Asotin Creek which is considered functionally extinct by the TRT.
Population Viability	*Low*. The Tucannon population is considered high risk. Recent abundance (number of adult spawning in natural production areas) has ranged from 897 in 2002 to 11 in 1995, with the return/spawner averaging 1.23 for brood year 1985-2003 (Appendix B Table 22). Hatchery returns have ranged from 25 to 830 with return/spawner averaging 2.25 for brood years 1985-2003 (Appendix B Table 22).
Habitat	*Low to Medium*. ICTRT classified population as Intermediate in size based on historic habitat potential. Also classified as type A population based on its relatively simple and linear spatial structure with a minimum abundance threshold of 750 wild spawners required.
Harvest	*Low*.
Hatchery Program	
Facilities	Lyons Ferry FH and Tucannon FH.
Type	Integrated.
Authorization and Funding	LSRCP
Primary Purpose	Harvest
Secondary Purposes	Conservation
Broodstock Origin(s)	Tucannon River

Table 3. Asotin Creek spring Chinook

Management Premises and Goals	
ESA Status	"Functionally Extirpated" (TRT)
Biological Significance	*High*. The Asotin Creek population is one of two historic populations in the lower Snake River. (the other historic population is Tucannon River). Asotin Creek was recently considered functionally extinct by the TRT.
Population Viability	*Very Low*. The Asotin Creek population is considered high risk. Very few spring Chinook occasionally utilize Asotin Creek. The population is not currently viable.
Habitat	*Low*. ICTRT classified population as Basic in size based on historic habitat potential. Also classified as type A population based on its relatively simple and linear spatial structure with a minimum abundance threshold of 500 wild spawners required.
Harvest	*Low*.

Table 4. Walla Walla spring Chinook

Management Premises and Goals	
ESA Status	*Extirpated*
Biological Significance	*Extirpated*.
Population Viability	Not available
Habitat	Lower Walla Walla River in-stream flow issues.
Harvest	*Low*

Table 5. Walla Walla (Carson stock) spring Chinook (Umatilla Tribal Hatchery)

Management Premises and Goals

ESA Status	*Not Listed*
Biological Significance	*Original Population Extirpated*. Confederated Tribes of the Umatilla Indian Reservation are re-introducing spring Chinook salmon using Carson hatchery stock. 250,000 yearling smolts transferred from Carson NFH to the Walla Walla River for direct stream release.
Population Viability	New program, little data available.
Habitat	Lower Walla Walla River in-stream flow issues.
Harvest	*Low*
Hatchery Program	
Facilities	Umatilla Tribal Hatchery and Carson National Fish Hatchery
Type	Segregated
Authorization and Funding	BPA and Mitchell Act
Primary Purpose	Re-introduction
Secondary Purposes	Harvest
Broodstock Origin(s)	Carson NFH spring Chinook

Table 6. Touchet River summer steelhead (endemic stock -Lyons Ferry FH)

Management Premises and Goals	
ESA Status	*Threatened*.
Biological Significance	*High.* Subbasins in this mid-Columbia River ESU include Yakima, Klickitat, Deschutes, John Day, Umatilla, and Walla Walla rivers (including Touchet River). On the basis of genetic and geographic data, the TRT designated the Touchet River as an independent population.
Population Viability	*Low to Medium*. Current returns to the Touchet River estimated at 400-500 adults, with 10 to 20% of those from both the endemic and Lyons Ferry FH programs. Recent smolt to adult survival for the endemic program was 0.5% for brood year 2005. Recovery goal is 1,000 naturally produced adults. Estimated smolt to adult (upstream of McNary Dam) survival rate of PIT tagged fish from

	the endemic hatchery program averaged 0.30 for years 2004-2006 smolt migration year (Table 2 of WDFW draft 2008 evaluation report).
Habitat	*Low to Medi*um. TRT classified spatial structure in the Touchet River as "branched discontinuous, intermediate in size with one major spawning area.
Harvest	*Low*. Endemic program is not fin clipped for selective fishery.
Hatchery Program	
Facilities	Touchet River adult collection facility and Lyons Ferry FH.
Type	Integrated
Authorization and Funding	LSRCP
Primary Purpose	Conservation
Secondary Purposes	Harvest
Broodstock Origin(s)	Touchet River in year 2000

Table 7. Walla Walla summer steelhead

Management Premises and Goals	
ESA Status	*Threatened*
Biological Significance	*High*
Population Viability	*Low to Medium*. The estimated annual spawning escapement for Walla Walla steelhead, upstream of Nursery Bridge averaged 389 natural (range 224-722) and 14 hatchery origin (range 2-29) for the years 1992-93 to 2000-01 (Table 4-6 of 2004 subbasin plan). Video counts in 2001-02 and 2002-03 were 1,205 and 547 total steelhead, respectively. Video did not distinguish natural from hatchery, but based on previous counts at Nursery Bridge, the number of Lyons Ferry stock fish spawning in this area appears to be small
Habitat	*Low to Medium*. TRT classified the Walla Walla mainstem as Intermediate in size with 5 major and 6 minor spawning areas. Recovery goal is 1,000 naturally produced adults.
Harvest	*Low*

Table 8.Tucannon River summer steelhead (endemic stock - Lyons Ferry FH)

Management Premises and Goals	
ESA Status	*Threatened.*
Biological Significance	*High*. Subbasins in this ESU include Tucannon, Clearwater, Grande Ronde, Imnaha, and Salmon rivers. The Lower Snake River includes the Tucannon River population (also includes nearby streams Alali, Almohta, Penawawa, and Apowa creeks) and Asotin Creek.
Population Viability	*Low to Medium*. Current returns to the Tucannon River estimated at 600-800 adults, with 50% of those from the endemic program. Recent smolt to adult survival for the endemic program was 1.3% for brood year 2005. Recovery goal is 1,000 naturally produced adults. Estimated smolt to adult (upstream of McNary Dam) survival rate of PIT tagged naturally produced smolts averaged 1.75% for 1999-2006 smolt migration years (Table 1 of WDFW 2008 draft evaluation report). For the endemic program, SAR for PIT tagged fish averaged 0.66 for 2004-2006 release years (Table 2 of WDFW 2008 draft evaluation report).
Habitat	*Low to Medium*. TRT classified spatial structure in the Tucannon as "branched discontinuous" and in Asotin Creek as "branched continuous". Population and habitat in the Tucannon was "Intermediate" in size with 1 major and 2 minor spawning areas and the Asotin was "Basic" in size with 2 major and 5 minor spawning areas. Both populations have potential for extensive temperature limitations.
Harvest	*Low*. Endemic program is not fin clipped for selective fishery.
Hatchery Program	
Facilities	Tucannon FH and Lyons Ferry FH
Type	Integrated
Authorization and Funding	LSRCP
Primary Purpose	Conservation
Secondary Purposes	Harvest
Broodstock Origin(s)	Tucannon River in year 2000

Table 9. Asotin Creek summer steelhead

Management Premises and Goals	
ESA Status	*Threatened.*
Biological Significance	*High*
Population Viability	*Low to Medium*
Habitat	*Low to Medium*. TRT classified Asotin Creek as "branched continuous". Population and habitat in Asotin was "Basic" in size with 2 major and 5 minor spawning areas. Population has potential for extensive temperature limitations. Recovery goal is 500 naturally produced adults.
Harvest	Low

Table 10. Lower Grande Ronde River summer steelhead

Management Premises and Goals	
ESA Status	*Threatened*
Biological Significance	*High.* This population includes natural origin steelhead in the Grande Ronde River and tributaries downstream from the Wallowa River, including the Wenaha River.
Population Viability	*Low to Medium.* The TRT has not published viability ratings for Snake River basin steelhead populations. Limited redd counts and fishery observations indicate that this population is persistent and well distributed but likely much less abundant than historical conditions.
Habitat	*Low to High.* The headwater areas of the Wenaha used for spawning and rearing are located within a designated Wilderness and remain in nearly pristine condition. Other tributaries have been impacted by land use including forestry and agriculture. The lower Grande Ronde River has been modified by land and water use and the migration corridor through the Snake and Columbia Rivers has been highly modified by dams, inundation, and regulated water flows. TRT classified the lower Grande Ronde River as Intermediate in size with 2 major and 5 minor spawning areas. Recovery goal is 1,000 naturally produced adults.
Harvest	*Low to Moderate.* Naturally produced steelhead are not marked for harvest (adipose fin clips) and are protected in recreational fisheries. There is a harvest impact of approximately 15% on A-run steelhead in the Tribal Columbia River gill net fishery and some incidental mortality in recreational fisheries (estimated at less than 2.5%).

Table 11. Joseph Creek summer steelhead

Management Premises and Goals	
ESA Status	*Threatened.*
Biological Significance	*High.* Genetic surveys by NOAA NW Fisheries Science Center identified Joseph Creek as a unique population within the Grande Ronde River (Paul Moran, unpublished)
Population Viability	*Low to Medium.* ODFW biologists believe this population to be intact ad resilient, but somewhat depressed in abundance
Habitat	Most of the Joseph Creek drainage lies on public land in Oregon; only about 10 miles of the lower main stem lies in Washington. Headwater streams have been impacted by logging, roads and grazing, but there is limited agriculture and no urban development in the drainage. Rearing areas include extensive unroaded canyons in good to excellent condition, but the migration corridor through the lower Grande Ronde, Snake, and Columbia Rivers is highly modified.
Harvest	*Low.*

Table 12. Wallowa River summer steelhead

Management Premises and Goals	
ESA Status	*Threatened*
Biological Significance	*High*. The Wallowa population includes the steelhead in the Minam and Lostine Rivers and Wallowa and tributaries.
Population Viability	*Low to Medium.* The ICTRT has not published viability ratings for Snake River basin steelhead populations. Limited red count, adult trapping, and fishery observations indicate that this population is persistent and well distributed but likely much less abundant than historical conditions.
Habitat	*Low to High.* The headwater areas used for spawning and rearing in Minam and Lostine River are located within designated Wilderness and remain in nearly pristine condition. Most other tributaries and the main stem of the Wallowa River have been modified by land and water use and the migration corridor through the Snake and Columbia Rivers has been highly modified by dams, inundation, and regulated water flows.
Harvest	*Low to Moderate*. Naturally produced steelhead are not marked for harvest (adipose fin clips) and are protected in recreational fisheries. There is a harvest impact of approximately 15% on A-run steelhead in the Tribal Columbia River gill net fishery and some incidental mortality in recreational fisheries (estimated at less than 2.5%).

Table 13. Upper Grande Ronde River summer steelhead

Management Premises and Goals	
ESA Status	*Threatened*
Biological Significance	*High.* This population includes natural origin steelhead in the upper Grande Ronde River, including Catherine and Lookingglass Creeks
Population Viability	*Low to Medium.* The TRT has not published viability ratings for Snake River basin steelhead populations. Limited red count, adult trapping, and fishery observations indicate that this population is persistent and well distributed but likely much less abundant than historical conditions.
Habitat	*Low to High.* The headwater areas used for spawning and rearing in Catherine Creek are located within a designated Wilderness and remain in nearly pristine condition. Most other tributaries and the main stem of the Grande Ronde River have been modified by land and water use and the migration corridor through the Snake and Columbia Rivers has been highly modified by dams, inundation, and regulated water flows.
Harvest	*Low to Moderate.* Naturally produced steelhead are not marked for harvest (adipose fin clips) and are protected in recreational fisheries. There is a harvest impact of approximately 15% on A-run steelhead in the Tribal Columbia River gill net fishery and some incidental mortality in recreational fisheries (estimated at less than 2.5%).

Table 14. Lyons Ferry hatchery summer steelhead (Lyons Ferry FH)

Management Premises and Goals	
ESA Status	*Not listed*. NOAA Fisheries excluded this stock from any existing ESUs
Biological Significance	*Low*. Admixture of hatchery fish from upper Columbia River (Wells stock) and Snake River (Wallowa stock).
Population Viability	*High*. A large number of returning hatchery origin adults are trapped each year at Lyons Ferry FH for broodstock (currently about 2,000 fish annually of which 40% are Lyons Ferry on-station release, 25% Touchet River, 25% Walla Walla River, and 10% Tucannon River release), most of which (1,000-1,200) are eventually returned to the Snake River to be harvested. For the Lyons Ferry on-station release, smolt to adult survival back to the Snake River project area was 1.7%, brood years 1982-2003. For the Touchet River release, smolt to adult survival back to the Snake River project area was 1.6%, brood years 1987-2003. For the Walla Walla River release, smolt to adult survival back to the Snake River project area was 1.5%, brood years 1989-2003. For the Tucannon River release, smolt to adult survival back to the Snake River project area was 1.4%, brood years 1989-2003. 300 to 400 spawned at Lyons Ferry produces 345,000 smolts for the entire program

	(release sites: 60,000 Lyons Ferry, 100,000 Tucannon, 85,000 Touchet, and 100,000 Wallla Walla rivers). On-station: Assuming 17% of the adults are for the on-station release, then 60 adult spawners produce 1,000 recruits for an approximate recruit/spawner of 17. Touchet River: Assuming 25% of the adults are for the on station release, then 88 adult spawners produce 1,360 recruits for an approximate recruit/spawner of 15. Walla Walla River: Assuming 30% of the adults are for the on-station release, then 105 adult spawners produce 1,500 recruits for an approximate recruit/spawner of 14. Tucannon River: Assuming 30% of the adults are for the on-station release, then 105 adult spawners produce 1,400 recruits for an approximate recruit/spawner of 13.
Habitat	The Lyons Ferry FH steelhead stock relies strictly on the mainstem Columbia and Snake rivers for migration. This habitat is significantly compromised by a series of six mainstem dams and pools. Returning adult steelhead must volitionally enter the hatchery from the pool behind Lower Monumental Dam on the Snake River.
Harvest	*High*. WDFW estimates annual harvest in the Snake River project area to be about 11,600 steelhead for the years 1985 to 2006. The WDFW creel census reports appear to reflect contribution from Lyons Ferry hatchery, Cottonwood Pond and additional interception of steelhead destined to return to upstream release sites in Oregon and Idaho. Based upon a release of 345,000 smolts @ 1.7% smolt to adult survival would return approximately 6,000 adults to project area; 60% harvest rate would be about 3,600 harvested.
Hatchery Program	
Facilities	Lyons Ferry FH, Dayton Pond
Type	Segregated
Authorization and Funding	LSRCP
Primary Purpose	Harvest
Secondary Purposes	Harvest
Broodstock Origin(s)	Wells (WDFW) and Wallowa (ODFW) hatcheries.

Table 15. Cottonwood Creek hatchery summer steelhead (Lyons Ferry FH)

Management Premises and Goals	
ESA Status	*Not listed*. NOAA Fisheries excluded this stock from any existing ESUs
Biological Significance	*Low*. Admixture of hatchery fish from Snake River (Wallowa stock).
Population Viability	*High.* A large number of returning hatchery origin adults are trapped each year at Cottonwood Pond for broodstock (currently about 800 to 2,000 fish annually). Smolt to adult survival back to the Snake River is 1.85%, brood years 1984-2003. 150 spawned produces 160,000 smolts produces 3,000 adults @1.85%SAR = 20 recruits per spawner.
Habitat	The Cottonwood Pond release relies strictly on the mainstem Columbia and Snake rivers for migration. This habitat is significantly compromised by a series of eight mainstem dams and pools.
Harvest	*High*. 3,000 estimated harvest in Snake River project area, 1997-2003 broods.
Hatchery Program	
Facilities	Cottonwood Pond and Lyons Ferry FH
Type	Segregated
Authorization and Funding	LSRCP
Primary Purpose	Harvest
Secondary Purposes	Harvest
Broodstock Origin(s)	Wallowa stock from trapping at Ice Harbor and Little Goose dams in early 1980s.

Table 16. Wallowa hatchery summer steelhead (Irrigon FH)

Management Premises and Goals	
ESA Status	*Not listed*
Biological Significance	*Low.* Not considered to be included in the listed Snake River Steelhead DPS.
Population Viability	*High. H*atchery population is abundant and productive.

Habitat	*Variable.* The hatchery population is negatively impacted by a modified migration corridor similar to natural populations.
Harvest	*Moderate to High.* All smolts produced from this program are marked for harvest. The Zone 6 Tribal commercial fishery takes approximately 15% of all A-run steelhead ascending the Columbia River, and recreational and tribal fisheries in the Snake River Basin take approximately 60% of the hatchery steelhead that pass Lower Granite Dam.
Hatchery Program	
Facilities	Irrigon and Wallowa FHs and Big Canyon satellite facility.
Type	Segregated. Irrigon Hatchery is a typical northwest steelhead production facility designed to rear one-year smolts using well water of fairly constant temperature. Incubation and early rearing take place in a hatchery building with final rearing in outdoor concrete raceways. The Big Canyon satellite facility consists of one large concrete acclimation ponds for final rearing and release of smolts produced at Irrigon Hatchery. Wallowa Wallowa Hatchery includes two large concrete acclimation ponds for final rearing and release of smolts produced at Irrigon Hatchery and an adult trap.
Authorization and Funding	Authorized and funded through the Lower Snake River Compensation Plan
Primary Purpose	Harvest. The primary purpose for the Wallowa steelhead program is mitigation for losses to fisheries from construction of the four Federal Dams on the lower Snake River and to restore tribal and recreational fisheries.
Secondary Purposes	
Broodstock Origin(s)	Wallowa stock from trapping at Ice Harbor and Little Goose dams in early 1980s.

Table 17. Oxbow hatchery (Lower Snake River, Hells Canyon) summer steelhead (Oxbow FH, Niagara Springs FH)

Management Premises and Goals	
ESA Status	*Not listed*. Oxbow FH steelhead are not included with the *Snake River Steelhead DPS*. The ICTRT (2005) classified the Hells Canyon, Snake River population of A-run steelhead, which is the progenitor stock for the Pahsimeroi and Oxbow FH populations, as *extirpated*. The HSRG (2009) classified the natural population below Hells Canyon Dam as *stabilizing* based on residual spawning and rearing habitat.
Biological Significance	*Medium*. This hatchery stock represents the genetic legacy of extirpated steelhead populations indigenous to the Snake River basin upstream of Hells Canyon.

Population Viability	*High.* The HSRG (2009) estimated the habitat productivity and capacity for A-run steelhead in the Hells Canyon region of the Snake River as R/S = 2.0 and 500 natural-origin adults, respectively. The HSRG (2009) estimated R/S = 12.6 for hatchery-origin Oxbow A-run steelhead released in the Hells Canyon region of the Snake River.
Habitat	*Low.* Historic spawning and rearing habitat for steelhead are blocked by the Hells Canyon complex of dams. Fish passage, water flows and temperature in the downstream migration corridor have been greatly impacted by dams on the Snake and Columbia rivers.
Harvest	*High.* Oxbow A steelhead contribute to sport and tribal fisheries in the Little Salmon River, the lower Snake River, and the lower Columbia River. For brood years 1992 to 1999, the sport fishery annually harvested an average of 220 (range 0-1,757) Oxbow A-run steelhead released into the Salmon River from Magic Valley FH and 1,580 (range 0-6,808) Oxbow A-run steelhead released into the Salmon River from Hagerman NFH.
Hatchery Program	
Facilities	Oxbow FH, Hells Canyon trap, and Niagara Springs FH. Oxbow FH A-run steelhead have been used in the past to "backfill" Sawtooth and Pahsimeroi FH A-run stocks reared at Hagerman NFH and Magic Valley FH.
Type	*Segregated.* Hatchery-origin fish are collected for broodstock at Hells Canyon Dam.
Authorization and Funding	Idaho Power Company Mitigation.
Primary Purpose	*Harvest.* Oxbow FH steelhead are reared at the Niagara Springs FH and released into the Little Salmon River (275,000 smolts) to support harvest and in the Snake River at Hells Canyon Dam (525,000 smolts) to support fisheries in the lower Snake River and provide adult returns for broodstock.
Secondary Purposes	*Conservation.* Although not explicitly stated as a purpose, the Oxbow FH stock represents the genetic legacy of natural populations of steelhead that are now extirpated upstream of the Hells Canyon Dam complex. Resident (non-anadromous) populations of *Oncorhynchus mykiss* (rainbow/redband trout) remain in those historic areas upstream of Hells Canyon.
Broodstock Origin(s)	The Oxbow FH stock of steelhead originated from the Pahsimeroi FH Stock, which was developed from natural-origin adult steelhead trapped at Oxbow and Hells Canyon dams from 1966 through 1970. The hatchery stock developed at Pahsimeroi FH may have included some steelhead and rainbow trout native to the Pahsimeroi River. Steelhead from the Pahsimeroi stock were first released into Hells Canyon in the early 1990's and returning fish founded the Oxbow FH stock.

Table 18. Lower Snake River rainbow trout (Tucannon River, Asotin Creek, lower Grande Ronde River)

Management Premises and Goals	
ESA Status	Included in DPS for Snake River steelhead populations

Biological Significance	Rainbow trout are sympatric with steelhead and interbreeding does occur
Population Viability	Local populations persist.
Habitat	See tables for Tucannon River, Asotin Creek, and lower Grande Ronde River steelhead. Smaller trout redds observed in upper reaches during steelhead spawning ground surveys presumed to be from rainbow trout (Joe Bumgarner, WDFW, pers. comm.)
Harvest	Recreational fishery, both catch- and- release and some harvest Harvest of resident rainbow/redband trout is limited to two fish per day over eight inches minimum total length. Hatchery-reared trout released in ponds and lakes provide a popular fishing opportunity in lowland areas and residual steelhead smolts are harvested as trout in the Snake River reservoirs and tributaries.

Table 19. Walla Walla and Touchet River rainbow trout

Management Premises and Goals	
ESA Status	Included in the DPS for mid Columbia River steelhead (HSRG 2009)
Biological Significance	Rainbow trout are sympatric with Walla Walla River steelhead and interbreeding does occur (HSRG 2009)
Population Viability	Local populations persist
Habitat	see stables for Walla Walla River and Touchet River steelhead. Smaller trout redds observed in upper reaches during steelhead spawning ground surveys presumed to be from rainbow trout (Joe Bumgarner, WDFW, pers. comm.)
Harvest	Recreational fishery, both catch- and- release and some harvest Harvest of resident rainbow/redband trout is limited to two fish per day over eight inches minimum total length.. Hatchery-reared trout released in ponds and lakes provide a popular fishing opportunity in lowland areas and residual steelhead smolts are harvested as trout in the Snake River reservoirs and tributaries.

Table 20. Grande Ronde River rainbow trout

Management Premises and Goals	
ESA Status	Included in the DPS for Snake River steelhead populations. Inland Columbia Basin redband trout are listed by the state as a sensitive species and protection of native trout is a high priority due to the ODFW Native Fish Conservation Policy
Biological Significance	*High*
Population Viability	*Low to Medium*. Rainbow-redband trout persist throughout the Grande Ronde River Basin. Populations are locally abundant particularly in wilderness streams including the Wenaha and Minam rivers and the upper Lostine River Isolation of small populations due to passage barriers and streams dewatered by irrigation is a concern.
Habitat	*Low to High*. Habitat in several headwater streams is in Wilderness and remains in nearly pristine condition. Other streams on public land provide fair habitat. Habitat is in excellent condition in the undeveloped headwaters, but low-elevation reaches have thermal and flow barriers and degraded habitat.
Harvest	*Low to moderate*. Fishing access is limited in many areas where Rainbow-redband trout are abundant . Recreational harvest is restricted by state regulations designed to protect wild, native trout and juvenile steelhead.

Table 21. Bull trout (Tucannon, Touchet, Grand Ronde, Asotin, Walla Walla, and Snake rivers)

Management Premises and Goals	
ESA Status	*Threatened*
Biological Significance	*High*
Population Viability	*Low to Medium*. Bull trout persist in isolated populations in headwater areas of the Walla Walla, Touchet, Tucannon and Asotin Creek[37]. Populations are locally abundant. Redd counts in the upper Tucannon River have ranged from 57 to167 for the years 1991-2001 (additional redds also found in upper Tucannon River tributaries, for example Bear Cr, Panjab Cr. and Meadow Cr.). Surveys in Asotin Creek are intermittent where 3 redds were

[37] *U.S. Fish and Wildlife Service (October 2002). Bull Trout (Salvelinus confluentus) Draft Recovery Plan, Portland, Oregon (Chapter 10: Umatilla and Walla Walla and Chapter 24: Snake River, Washington).*

	found in 1996 and 59 redds were found in 1999 (with 9 additional redds in Cougar Creek). For the Walla Walla basin redd counts have ranged from 300 to 750 for years 1994-2000 (combined total for South Fork Walla Walla, Mill Cr. And Touchet River).
Habitat	*Low to Medium*. Habitat in the upper Tucannon is in Wilderness, in Mill Creek is a protected municipal watershed. Habitat is in excellent condition in the undeveloped headwaters, but low-elevation reaches have thermal and flow barriers and degraded habitat
Harvest	*Low*. Access is limited to areas where bull trout are abundant and harvest is prohibited by state regulations.

Other Species of Concern

Table 22. Non-salmonid fish species native to the Snake, Wallowa, Touchet, Tucannon, and Grand Ronde (and Asotin if releases occur there) watersheds[38]

Common name	Scientific Name
Suckers	*Catostomussp. (4 species)*
Chiselmouth	*Acrocheilus alutaceus*
Largescale sucker	*Catostomus macroheilus*
Dace	*Rhinichthys sp. (4 species)*
Sculpins	*Cottus sp.* (6 species)
Mountain whitefish	*Prosopium williamsoni*
Northern pikeminnow	*Ptychocheilus oregonensis*
Pacific lamprey[39]	*Lampetra tridentata*
Brook Lamprey	*Limper richardsoni*
River lamprey	*Lampetra ayresi*
Redside shiner	*Richardsonius balteatus*
Sandroller	*Percopsis transmontana*
Peamouth	*Mylocheilus caurinus*
White sturgeon	*Acipenser transmontanus*

Avian predators commonly observed include gulls, bald eagle, osprey, great blue heron and kingfisher. River otters also occur in the region and have the potential to prey on program fish. Caspian tern and white pelican nesting colonies on artificial islands in Lake Wallula, near the mouths of the Snake and Walla Walla Rivers are known to take numerous hatchery salmon and steelhead smolts (Columbia River Bird Reports).

Relevant Salmon and Steelhead Hatcheries in the Region[40,41]

Lyons Ferry Fish Hatchery (Washington Department of Fish and Wildlife and LSRCP)

The Lyons Ferry FH is located along the Snake River at river mile (RM) 59.1, directly below the confluence of the Palouse River in Franklin County, Washington. The hatchery was constructed under the LSRCP Program to offset fish losses caused by the construction and operation of four hydropower dams on the lower Snake River. The hatchery was completed and became operational in 1984. Initially

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[38] *xxxxxx.*
[39] *Pacific lamprey is a "species of special concern".*
[40] *See Figure 3.*
[41] *Descriptions of the facilities located in the Clearwater River Basin (Nez Perce Tribal Fish Hatchery, Big Canyon Fall Chinook Acclimation Project, Dworshak) that receive fall Chinook transfers from Lyons Ferry are described in the Team's Lower Snake NFH Assessments and Recommendations Report, http://www.fws.gov/Pacific/Fisheries/Hatcheryreview/index.html*

it was operated as two separate facilities. Washington Department of Wildlife (WDW) operated the north hatchery, producing steelhead and rainbow trout. Washington Department of Fisheries (WDF) operated the south hatchery, rearing spring and fall Chinook. A merger of the two agencies in 1994 led to a merging of the two facilities, and has since been operated by WDFW through LSRCP funding. The hatchery rears Snake River fall Chinook, Tucannon River spring Chinook, four stocks of steelhead, and two stocks of rainbow trout. Four satellite acclimation facilities (see below) are associated with the hatchery: *Captain Johns Acclimation Facility* on the Snake River between Asotin, Washington and the mouth of the Grand Ronde River at RM 164 (fall Chinook release site); *Pittsburgh Landing Acclimation Facility* at RM 215 of the Snake River, approximately 31 miles downstream from Hells Canyon Dam (fall Chinook release site); *Cottonwood Creek Acclimation Facility* at RM 29 of the Grande Ronde River at Cottonwood Creek (steelhead release and adult broodstock collection site); and *Dayton Pond Acclimation Facility* at RM 53 of the Touchet River within the Walla Walla River watershed (steelhead release and adult broodstock collection site).

Tucannon FH and Curl Lake Acclimation Facility (Washington Department of Fish and Wildlife and LSRCP)

The Tucannon FH is located along the Tucannon River, between the towns of Dayton and Pomeroy Washington, at RM 36 in Columbia County. Fish production began in 1949 by the Washington Department of Game. In 1983, construction began to remodel the hatchery as part of a transfer of ownership to LSRCP in 1991.[42] In November 1986 construction was complete, and LSRCP has funded operations there ever since. The hatchery currently supports steelhead, spring Chinook, and resident rainbow trout programs under the LSRCP. The Curl Lake Acclimation Facility is located along the Tucannon River at RM 41 in Columbia County, Washington. The construction of the Curl Lake facility was completed in February 1985. Curl Lake receives approximately 114,000 spring Chinook from Tucannon FH in February for acclimation and release in April.

Captain Johns Acclimation Facility (Nez Perce Tribe and LSRCP/BPA)

This site is located at Captain John Rapids on the Snake River between Asotin, Washington and the mouth of the Grand Ronde River at RM 164. The site is on the Washington side of the river, 20 miles upstream of Asotin, WA. The facility began operations in 1998. Lyons Ferry FH provides up to 150,000 yearling and 500,000 sub-yearling fall Chinook for acclimation and release from Captain Johns Acclimation Facility operated by the Nez Perce Tribe. Size at transfer is 12 fish per pound for yearlings and 65 - 75 fish per pound for sub-yearlings. Size at release goal for acclimated fall Chinook yearlings is 10.0 fish per pound, and 50 fish per pound for sub-yearlings.

Pittsburgh Landing Acclimation Facility (Nez Perce Tribe and LSRCP/BPA)

Pittsburg Landing is located in the Hells Canyon National Recreation Area (HCNRA) near Whitebird, Idaho. The site is located on the Idaho side of the Snake River at River Mile (RM) 215, about 31 miles downstream of Hells Canyon Dam. The facility began operations in 1996. Lyons Ferry FH provides up to 150,000 yearling and 400,000 sub-yearling fall Chinook for acclimation and release from Pittsburg Landing Acclimation Facility operated by the Nez Perce Tribe. Size at transfer is 12 fish per pound for yearlings and 65 - 75 fish per pound for sub-yearlings. Size at release goal for acclimated fall Chinook yearlings is 10.0 fish per pound, and 50 fish per pound for sub-yearlings.

Big Canyon Acclimation Facility

[42] *The USFWS accepted the transfer of ownership from the Army Corps of Engineers on March 25, 1991.*

The Nez Perce Tribe operates and maintains three satellite facilities developed since 1996,: two facilities on the Snake River and one facility at the confluence of Big Canyon Creek and the Clearwater River. Each satellite acclimates and releases fall Chinook smolts reared at Lyons Ferry Hatchery. Up to 150,000 yearling smolts are acclimated and released at each facility each year. Up to 1.8 million subyearling have also been acclimated and released by dividing them between the three satellite facilities. Fish released from the three satellite facilities are uniquely marked and returning adults are allowed to ascend upstream of Lower Granite Dam to spawn naturally.

Cottonwood Pond Acclimation Facility (Washington Department of Fish and Wildlife and LSRCP)

Cottonwood Acclimation Facility is located along the Grande Ronde River at RM 28.7, directly above the confluence with Cottonwood Creek in Asotin County, Washington. Construction was completed in February 1985. It is presently used for acclimation and release 160,000 Wallowa stock summer steelhead into the Grande Ronde River at 4.5 fish per pound. Fish from Lyons Ferry FH are transferred to Cottonwood acclimation pond in Feb at 7 fish per pound. This facility includes an adult trapping facility on Cottonwood Creek with a goal of collecting gametes from 50 females and males that are shipping to Lyons Ferry FH for fertilization, incubation and rearing.

Dayton Pond Acclimation Facility (Washington Department of Fish and Wildlife and LSRCP)

Dayton Acclimation Facility is located along the Touchet River at RM 53 in Columbia County, Washington. There is an adult trapping facility on the Touchet River just upstream of the acclimation pond at RM 53.3. Construction of the Dayton AF was completed in October 1986. It is presently used for acclimation and release of Lyons Ferry FH stock summer steelhead into the Touchet River. About 87,000 steelhead are transferred from Lyons Ferry FH to Dayton AF in mid-February for a release in April at 4.5 fish per pound. Trapping of Touchet River endemic stock begins in January or February (depending on seasonal weather) at the Dayton AF adult trap, located adjacent to the pond intake, and is completed by mid-April. Only a portion of unmarked adults are transferred to Lyons Ferry FH based on broodstock needs. Trapped Lyons Ferry FH stock steelhead will be returned downstream of the ladder. Lyons Ferry FH typically needs to spawn only 15 females to provide 65,000 green eggs for the program. Fish in excess to the interim program smolt goals (maximum 75,000 smolts) are planted into the Touchet River as fingerlings in the fall

Oxbow Fish Hatchery (Idaho Power Company, IPC/ Idaho Department of Fish and Game)

The Oxbow Fish Hatchery is owned by Idaho Power Company and is located Oxbow Dam on the Snake River. The IDFG operates the facility under contract. Idaho Power Company's current mitigation goal for steelhead production at Oxbow FH is to trap and spawn a sufficient number of adult steelhead to allow for the production of 200,000 lbs of steelhead smolts at Niagara Springs FH. To produce the minimum 1.2 million eyed-eggs/ fry necessary to reach that goal, approximately 550 adult steelhead are trapped in the fall and held over winter. An additional 50 females or 10% of the broodstock are trapped the following spring. This provides for pre-spawning mortality, culling for disease management and manipulation of run timing. It will also provides a small surplus for use at Pahsimeroi FH and Sawtooth FH in the event that returns to their weirs do not meet production goals

Steelhead spawning occurs in the spring and the resulting eggs and swim-up fry are transferred to Niagara Springs FH beginning in June.[43]

Umatilla Hatchery (Idaho Power Company, IPC/ Oregon Department of Fish and Game)

Umatilla Hatchery is located adjacent to the Columbia River, 3.5 miles west of Irrigon, Oregon. The site is at an elevation of 277 feet above sea level, at latitude 45o 54' 79" N (45.9114) and longitude 119o 33' 28" W (119.5504). The site area is 23 acres, owned by the US Army Corps of Engineers. The Umatilla Hatchery was authorized under the Northwest Power Planning Council's (NPPC) Fish and Wildlife Program and began operation in 1991. Hatchery funding is provided by Bonneville Power Administration. The hatchery is used for egg incubation and rearing of spring Chinook, fall Chinook and summer steelhead.

Satellite facilities provide for broodstock collection and adult holding, as well as, juvenile acclimation. Three-Mile facility provides adult trapping and holding, and Minthorn and South Fork Walla Walla are used for adult holding. Juvenile acclimation occurs at Pendleton, Minthorn, Thornhollow, and Imeques facilities. The satellite facilities are maintained and staffed by the Confederated Tribes of the Umatilla Indian Reservation.

Production includes:

- Fall Chinook: Umatilla River Stock:: 550,000 eggs to Bonneville Hatchery and 600,000 sub-yearlings (13,500 pounds) for release into the Umatilla River. Snake River Stock: 800,000 sub-yearlings (16,000 pounds) for the Idaho Power Company for release into the Snake River below Hells Canyon Dam.

- Spring Chinook: Umatilla River Stock: 810,000 smolts (54,000 pounds) for acclimated release into the Umatilla River.

- Summer Steelhead: Umatilla River Stock: 150,000 smolts (31,313 pounds) for acclimated release into the Umatilla River.

Nez Perce Tribal Fish Hatchery (Nez Perce Tribe)

The Nez Perce Tribal Hatchery is located at river mile 38 (rkm 61) of the Clearwater River near the Cherry Lane Bridge. The hatchery is funded by BPA via the authority of the Northwest Power and Conservation Act. This facility mitigates for the loss of naturally-reproducing salmon in the Clearwater River subbasin resulting from hydroelectric development in the Columbia and Snake rivers. The purpose of the facility is to produce and release fish that will survive to adulthood, spawn in the Clearwater River subbasin, and produce viable offspring that will support future natural production, genetic integrity, and harvest opportunities. The hatchery includes satellite facilities on the lower South Fork Clearwater and lower Selway rivers, respectively. Those facilities are used to initiate restoration and reestablishment of "early-run" populations of fall Chinook salmon in the Clearwater River subbasin.

Fall Chinook production is targeted at 1.4 million subyearling juveniles. Targeted releases are: 1) 500,000 smolts on station to the Clearwater River (Site 1705) in June of the year. 2) Approximately

[43] *Salmon River AOP, p 24*

200K subyearling juveniles are transferred to the North Lapwai Valley acclimation facility in April for release to the Clearwater River in May. 3) 200,000 juveniles are transferred to the Lukes Gulch acclimation facility in late April-early May and released to the South Fork Clearwater River in mid June, and 4) 200,000 juveniles are transferred to the Cedar Flats acclimation facility in late April-early May and released to the Selway River in mid June.

Lyons Ferry Fall Chinook

Operator: Washington Department of Fish and Wildlife

Summary of Current Program

Goals

- ***Harvest goal:*** No quantified "harvest" goal exists for this program separate from the LSRCP adult mitigation return goals. The total adult return goal under the LSRCP program is to return 18,300 hatchery-origin fall Chinook upstream of Ice Harbor Dam. Of those returning adults, approximately 3,600 adults are required for broodstock at Lyons Ferry FH and the remaining fish are available to supplemental natural spawning in the Snake River or for harvest. Based on the draft fall Chinook management plan, the long-term goal is to return 24,750 hatchery-origin fall Chinook to the project area. The long-term goal includes the LSRCP, Idaho Power and Nez Perce Tribal Hatchery production.

- ***Broodstock escapement goal:*** Collect approximately 3,400-3,500 fall Chinook adults (~1,600 females) and 200 jacks for broodstock for the Lyons Ferry fall Chinook salmon program. This is the total number of fish that must be collected to meet egg take goals listed in priority seventeen of the current *US v OR* agreement. The number of broodstock collected is dependent upon fecundity to stay below a stray rate proportion of <5%. Generally, between 3,000 and 5,000 fish are trapped at Lower Granite Dam and Lyons Ferry FH

- ***Conservation goal:*** Conserve and perpetuate the unique Snake River fall Chinook population and its biological and genetic characteristics. The Snake River fall Chinook ESU, which includes Lyons Ferry fall Chinook, is listed as threatened under ESA.

- ***Escapement goal for natural-origin adults:*** A minimum of 80% of all natural-origin adults must remain in the natural environment, with a maximum of 20% retained for broodstock, as measured at Lower Granite Dam. The ICTRT recommended recovery targets for Snake River fall Chinook adult abundance and productivity are 3,000 and 1.5 respectively. Of the 3,000 adult spawners, the ICTRT recommends that at least 2,500 of the fish spawn in the mainstem Snake River.

  The recovery goal for listed Snake River fall Chinook is under development**.** The Draft fall Chinook management plan states that approximately 14,360 natural-origin spawners are desired to meet the natural-origin return level prior to construction of the dams. The short-term goal in the plan is 7,500 natural-origin spawners.

- ***Research, education, and outreach goals:*** Provide surrogates for the wild fall Chinook population for various studies (e.g. juvenile downstream transportation studies).

  Provide accurate information and educational opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Lyons Ferry FH and LSRCP programs. The Dayton Lab monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex.

Objectives

- Trap up to 5,000 adult fish at Lower Granite Dam and Lyons Ferry FH to provide 3,400-3,500 fall Chinook adults (1,600 females) and 200 jacks for broodstock for the program, for analyzing coded-wire tags for program evaluation, and for run reconstruction/composition purposes (this goal is the total number of fish that need to be trapped to meet egg take goals listed in priority seventeen in the *US v OR* agreement).

- Spawn 1,600 females and 1,600 males to yield 4.95 million green eggs (4.6 million eyed eggs).

- Transfer 1,053,000 eyed eggs to IDFG and ODFW for Hells Canyon mitigation (842,000 for Umatilla Hatchery and 211,000 for Oxbow FH);

- Transfer 421,000 eyed eggs to Irrigon FH (release goal of 400,000 subyearlings into the Grande Ronde River) as part of the LSRCP mitigation program

- Utilize 345,000 eyed eggs at Lyons Ferry FH or transfer the eggs to Irrigon FH or Dworshak NFH to be reared for use in an US Army Corps of Engineers transportation study.

- Retain approximately 2.8 million eyed eggs for LSRCP program releases in the Snake River (release locations in table below).

- Production in excess of program goals are released in association with one of the groups in the table below, as determined by the comanagers.

Proposed BY2008 Snake River fall Chinook tagging, transfers and releases.

Site	**Priority** *(US v. Oregon)*	**Transfer Goal**	**Release Goal**	**Size (fish per pound)**	**Age**	**Mark/CWT/ Elastomer**	**PIT Tags**	**Transfer/ Release Date**
Oxbow Hatchery (Idaho Power Company (IPC))	9	211,000	200,000	Eyed Eggs	0+	100% AD CWT	10,000	Jan – Feb 2009 (transfer)
Umatilla Hatchery (IPC)	15 (for 200k) 17 (for 600k)	842,000	800,000	Eyed Eggs	0+	200K AD CWT 600K AD Only	NA	Jan – Feb 2009 (transfer)
Lyons Ferry FH /Irrigon FH /Dworshak NFH/research (transportation study)	12 (for 250k) 14 (for 70k)	345,200	328,000	Eyed Eggs	0+	Unknown	328,000	Jan – Feb 2009 (transfer)
Lyons Ferry FH	5	0	200,000	50	0+	100% AD CWT	47,222	May – Jun 2009
Grande Ronde Direct Stream Release- Irrigon FH	13 (for 200k) 16 (for 200k)	421,000	400,000	Eyed Eggs	0+	200K ADCWT 200K Unmarked	3,500	Jan – Feb 2009 (transfer)

Capt. John	6	500,000	100,000 100,000 300,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Big Canyon	7	500,000	100,000 100,000 300,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Pittsburg Landing	8 (for 200k) 10 (for 200k)	400,000	100,000 100,000 200,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Direct near Capt. John	11	200,000	200,000	50	0+	100% AD CWT	3,500	June 2009
Lyons Ferry FH	1	450,000	450,000	10	1+	225K AD CWT VIE 225K CWT VIE	30,000	April 2010
Capt. John	4	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Feb - 2010 (transfer)
Pittsburg Landing	2	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Mar - 2010 (transfer)
Big Canyon	3	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Mar - 2010 (transfer)

Program Description

Lyons Ferry FH (Phase II) was constructed in 1984 under the LSRCP Program, as authorized by the Water Resources Development Act of 1976, Public Law 94-587, to offset losses caused by the four Lower Snake River dam and navigation locks projects. Lyons Ferry FH was designed to rear 101,800 pounds (9,162,000 smolts) of fall Chinook salmon (90 fish per pound) for release. The adult return goal for the program is 18,300 fall Chinook salmon back to the project area (above Ice Harbor Dam).

After the LSRCP program was established in 1976, WDFW initiated a fall Chinook egg bank development program for the Snake River to preserve and enhance the now listed Snake River fall Chinook population. The program originally was scheduled to produced 9.16 million fall Chinook subyearlings for release from Lyons Ferry FH, and stream release sites as part of Idaho Power mitigation, at around 90 fish per pound. Currently the facility produces 1.8 million subyearlings at approximately 50 fish per pound, and another 900,000 yearlings at 10-12 fish per pound. Additionally, the facility traps and spawns returning adult fall Chinook to meet egg take needs elsewhere, which includes providing over 1,000,000 eggs (1.0 million smolts) annually for the IPC program. A program change was implemented in 2007 which includes 421,000 eyed eggs (400,000 smolts) from Lyons Ferry FH transfer to Oregon Fish and Wildlife (ODFW) for rearing at the Irrigon Hatchery. Adult trapping for the program occurred at Ice Harbor Dam between 1977 and 1993. Fall Chinook have been trapped on-site at Lyons Ferry FH since 1984 and at Lower Granite Dam since 1990.

Fall Chinook salmon production in the Clearwater River occurs through two programs –the LSRCP fall Chinook acclimation project and the Nez Perce Tribal hatchery

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Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- The Snake River fall Chinook are managed as one population across several facilities.
- Both the natural and hatchery populations of Snake River fall Chinook are listed as threatened under the Endangered Species Act.
- Two out of the three fall Chinook populations identified by the TRT are extinct (Marsing Reach and Salmon Falls). Snake River fall Chinook is the only remaining major population group for the Snake River fall Chinook ESU.
- The incidence of stray fish in the broodstock at Lyons Ferry FH began increasing until 1989 when it was determined after spawning that 41% of fish used for broodstock were strays from fall Chinook programs outside the Snake River basin. Moreover, the management agencies were concerned that strays were spawning in the wild with natural Snake River stock and the integrity of the natural population was being compromised. The 1989 brood year were not used as broodstock.
- In 1990, trapping also began at Lower Granite Dam to monitor and remove strays from the Snake River and to supplement broodstock for Lyons Ferry FH.
- As of 1990, WDFW began reading coded-wire tags to determine origin of fish prior to spawning. Until 2003, any fish of unknown origin were removed at Lower Granite Dam and excluded from the broodstock used for supplementation releases (to maintain the integrity of the natural population). Genetic sampling and characterization has been done and results indicate that Snake River stock reared at Lyons Ferry FH are indeed closer to the original natural spawning population in the Snake River than the Columbia River stocks or the Snake River population during high stray rate years.
- In 1993 trapping ceased at Ice Harbor dam because of the high number of strays from the Columbia River that were detected during a three-year radio telemetry project and verified through coded-wire tag analyses.
- In 2003, the program began including unmarked/untagged females in the broodstock in an effort to include natural-origin fall Chinook and untagged in-basin hatchery-origin fish in production. Scale analysis was used in an attempt to differentiate natural-origin from unmarked/untagged hatchery-

origin fish, but as of 2007, it was unable to determine in-basin from out-of-basin hatchery fish. In 2004, unmarked/untagged females (both hatchery and natural-origin) from both trapping locations (Lyons Ferry FH and Lower Granite Dam) were used for broodstock. DNA was used in 2007 to determine origins of untagged hatchery fish, but it was only able to assign origins to approximately 30% of the fish with 85% confidence. WDFW is seeking to identify ways to tag production for a more accurate determination of origin of returning adults.

- Since 2005, natural-origin males have been incorporated in the broodstock.

- As of 2008, WDFW increased the priority for trapping at Lower Granite Dam to increase the proportion of natural-origin broodstock and now backfill with fish trapped at Lyons Ferry FH. Historically, trapping was maintained at Lyons Ferry FH due to concerns regarding adult migration above the dams. Now that a set sample rate is required at Lower Granite Dam and there is a need for incorporating natural-origin Chinook, Lower Granite has become the priority location for broodstock collection.

- Bringing natural-origin fall Chinook into the broodstock is difficult because approximately 50% of the released fall Chinook in the Snake River basin are unmarked.

- Less than 1% of the natural-origin fall Chinook returning to the Snake River enter the Lyons Ferry FH ladder.

- Of the adults trapped at Lower Granite Dam, 70% are shipped to Lyons Ferry FH and 30% are shipped to the Nez Perce Tribal Hatchery. This is done to mimic historic natural production in the Snake River basin and reflects Lyons Ferry FH as the priority location for maintaining the population.

- The majority of broodstock are collected at Lyons Ferry Hatchery.

- Broodstock collection protocols at Lower Granite Dam (LGD):
    - Trapped fish meeting criteria for collection are transported: ≈70% to Lyons Ferry Hatchery and ≈30% to Nez Perce Tribal Hatchery. Scan all fall Chinook for wire and PIT tags.
    - Any fish hauled to Lyons Ferry FH or Nez Perce Tribal Hatchery must be given a right operculum punch. All released fish must be given a left operculum punch and be scale sampled prior to release.
    - Collect and haul: (a) All wire-tagged fall Chinook adult and jacks (31-52 cm); (b) Two-out-of-three unmarked/untagged adult fall Chinook. Collect scales on 50% of these fish; (c) All adipose-fin clipped only (no wire) adult fall Chinook.
    - Pass upstream: (a) Every third unmarked/untagged adult fall Chinook; (b) All unmarked/untagged fall Chinook jacks; (c) All adipose-fin-clip-only (no wire) jack fall Chinook; (d) All mini-jacks (30 cm or less).
    - Broodstock collection protocols at Lyons Ferry Hatchery (Lyons Ferry FH):
    - Fish retained for broodstock collection are transferred to the holding pond every day to reduce stress to fish.
    - Fish captured at Lyons Ferry FH are held separately from fish collected at LGD.
    - Collect all adults and jacks.

- Collect and sacrifice approximately 100 fish (<40cm FL) throughout the run for coded-wire tag analysis.
- Count and record the number of fish returned to the river each day.
- Sampling During Spawning:
- Collect, retrieve and decode wire from 100% of Lyons Ferry FH trapped and LGR trapped wire tagged fish
- Collect scale samples from all fish without wire (adipose-fin clip only, VIE only, or unmarked/untagged)
- Scan all fish for PIT tags
- Females are weighed each spawning day as time allows
- See mating and spawning protocols below.

- Adult collection protocols do not allow 100% exclusion of unmarked/untagged hatchery-origin strays from being included in the broodstock. However, adult collection protocols (including the screening of each fish for tags, marks, and scale readings) are believed to minimize the inclusions of unmarked/untagged hatchery-origin fish in the broodstock.

- Steelhead are at times inadvertently collected in the fall Chinook ponds during collection. This occurs because steelhead are collected simultaneously.

- Coho are collected at Lyons Ferry FH during collection of fall Chinook. The coho are taken to Dworshak NFH for the Nez Perce Tribe's Clearwater coho program. The Team has recommended discontinuation of the practice of including coho trapped at Lyons Ferry Hatchery with the Clearwater River broodstock.[44]

Hatchery and Natural Spawning, Adult Returns

- Fall Chinook occupy the Snake River from its confluence with the Columbia River to Hells Canyon Dam, and the lower reaches of the Clearwater, Imnaha, Grande Ronde, Salmon, and Tucannon Rivers. The majority of the fish spawn in the mainstem Snake River between the head of Lower Granite Reservoir (RM 146.8) and Hells Canyon Dam (RM 247.6), with the remaining fish distributed among lower sections of the major tributaries.

- The total adult return goal under the LSRCP program is to return 18,300 hatchery-origin fall Chinook upstream of Ice Harbor Dam. The LSRCP mitigation goal was based on the assumption that three-quarters of returning adults would be caught downstream of Ice Harbor (presumed 3:1 recreational-to-commercial catch ratio), while one quarter of the returning adults would be available for recreational and tribal/commercial fisheries upstream of Ice Harbor Dam (presumed 1:1 catch ratio).

- 85% of the fall Chinook habitat has been lost in the Snake River due to dam construction. Human development and land management impacts, consistent with those identified across the Columbia and Snake River basins, affect natural fall Chinook production in the Snake River. Loss of channel diversity, increased sedimentation, reduced stream flows, habitat constriction due to effects of

[44] *Dworshak, Kooskia, and Hagerman National Fish Hatcheries: Assessments and Recommendations. Final Report, June 2009. http://www.fws.gov/Pacific/ fisheries/Hatcheryreview/reports.html.*

irrigation withdrawn, water temperature, and inundation and loss of spawning/rearing habitat through dam construction, and fragmentation of habitat all affect productivity of natural fall Chinook populations within the watershed. The Lower Snake River dams have contributed largely to habitat loss; however, the Upper Snake River dams, including the Hells Canyon complex, have had the greatest impact on the fall Chinook habitat.

- Estimated numbers of returning natural-origin Snake River fall Chinook salmon have varied greatly since 1975, with estimates of natural-origin fish passing above Lower Granite dam averaging 1,543 (range 101 - 6,607) per year from 1975 to 2007.

Return year	Total # fall Chinook to LGR	Hatchery	Natural	% Natural
1975	1000	0	1,000	100.00%
1976	470	0	470	100.00%
1977	600	0	600	100.00%
1978	640	0	640	100.00%
1979	500	0	500	100.00%
1980	450	0	450	100.00%
1981	340	0	340	100.00%
1982	720	0	720	100.00%
1983	540	112	428	79.26%
1984	640	316	324	50.63%
1985	691	253	438	63.39%
1986	784	335	449	57.27%
1987	951	698	252	26.50%
1988	627	259	368	58.69%
1989	706	411	295	41.78%
1990	575	474	101	17.57%
1991	1019	701	318	31.21%
1992	957	337	620	64.79%
1993	1209	432	777	64.27%
1994	1037	328	484	46.67%
1995	1375	996	379	27.56%
1996	1732	898	840	48.50%
1997	1955	1,134	821	41.99%
1998	3911	3,284	627	16.03%
1999	5237	3,515	1,722	32.88%
2000	10994	7,335	3,659	33.28%
2001	17915	11,285	6,630	37.01%
2002	18478	11,871	6,607	35.76%
2003	21047	16,714	4,333	20.59%
2004	22077	15,711	6,366	28.84%
2005	13,985	10,558	3,427	24.50%
2006	15,664	11,987	3,677	23.47%
2007	20,960	18,687	2,273	10.84%

11/5/08 Debbie Milks, WDFW
Historical run of hatchery and wild fall Chinook to Lower Granite River Dam
Does not include fish trapped at Lyons Ferry Hatchery or fall Chinook to the Tucannon River
Does not take into account fish removed from the run for Spawning needs at Lyons Ferry FH or Nez Perce Tribal Hatchery

- The weighted mean SAR to the Snake River was 0.53% for yearlings (brood years 1990-1998) released on station at Lyons Ferry FH. When all recovery and return data are included, the total mean SAR was 0.96%. Survivals have improved in recent years. The 5-year weighted mean SAR to the Snake River (brood years 1994-1998) was 0.84% for yearlings released on station at Lyons Ferry FH: contributing to a total mean SAR of 1.56% when all recovery and return data were included.

- Survivals appear to have improved in recent years for subyearlings also. The weighted mean SAR to the Snake River was 0.35% for subyearlings (BY90, BY92, and BY98) released on station at Lyons Ferry FH, with a total weighted mean SAR of 0.62%.

- Yearling releases out performed subyearling releases in all but two brood years (1990 and 1992). Overall yearling survival has increased except for BY1994 and BY1996. (Note: The 1996 flood event could have contributed to low returns from the BY1994 releases). The SAR data presented here will be compared with survivals of fish released from upstream Nez Perce Tribal acclimation facilities in a future cooperative report.

- Comanagers' desire is to include 10-30% naturally produced Snake River stock fall Chinook in Lyons Ferry FH broodstock annually. Any Snake River origin hatchery adults, transferred and held at Lyons Ferry FH and not needed for production, monitoring, or run reconstruction are returned to the Snake River at Lyons Ferry FH to "supplement" the natural population. The majority of unmarked fish are allowed to spawn naturally in the Snake River each year.

- Lyons Ferry began incorporating natural-origin fall Chinook into their broodstock beginning with broodyear 2003 collections. From 2003 through 2008 the percent natural-origin used in the broodstock has averaged 5.4% (2003-0.12%, 2004-4.9%, 2005-5.3%, 2006-12.6%, 2007-3.3%, and 2008-5.9%).

- The Snake River fall Chinook salmon ESU has been greatly influenced by the Lyons Ferry FH. The Lyons Ferry FH stock was founded from the native stock, and has been propagated through the Lyons Ferry, Idaho Power, and Nez Perce Tribal Hatchery programs. The Lyons Ferry stock has been through several generations of artificial propagation and there is evidence of inclusion of out-of-basin strays and exclusion of natural-origin Snake River fall Chinook in the broodstock.

- In addition to the Lyons Ferry stock hatchery fish, non-Snake River hatchery fall Chinook salmon have been identified at Lower Granite Dam since the mid 1980s. The NOAA Fisheries Biological Review Team noted the primary contributor of non-ESU hatchery strays continues to be from the Umatilla (Priest Rapids stock). The percentages of non-ESU fish in the escapement to Lower Granite Dam has dropped in recent years and is now less than 5% due to systematic removal of the strays identified at the dam and changes to the Umatilla program, including a substantial decrease in production and implementing methods to increase homing. In the past, the largest number of strays came from subyearlings. Presently, the yearling Umatilla program contributes the highest number of strays to the Snake River (detected at Lower Granite and Lyons Ferry FH). Currently, all the Umatilla releases are tagged so that they can be detected.

- Due to facility and handling constraints at Lower Granite Dam, only about 15% of the strays can be removed.

- Lyons Ferry fall Chinook adults sometimes stray (8 coded-wire tag recoveries in the Hanford Reach for fall Chinook salmon released from Lyons Ferry Hatchery in the 1980s) into the Hanford Reach and spawn[45].

- Lyons Ferry FH origin fish (determined by coded-wire tag, elastomer tag, DNA or scale analysis) are retained for broodstock. Natural-origin Snake River fish are incorporated into the broodstock at a target rate of up to 30% (per the Snake River Fall Chinook Management Plan), provided that this number does not exceed 20% of the natural-origin spawning population. Stray (non-Lyons Ferry FH origin) hatchery fish as determined by coded-wire tag are culled if not needed by other Columbia Basin hatcheries (based on needs described in US vs. Oregon).

- Mating protocol is to minimize incorporation of strays in the Lyons Ferry FH broodstock while incorporating as many natural-origin fall Chinook as possible (up to 30% of the fish used for broodstock).
    - Fall Chinook matings conducted at Lyons Ferry FH:
    - Jacks are to be used in no more than 10% of the matings.
    - Gametes from wire-tagged strays are discarded.
    - Known Lyons Ferry FH fish (coded-wire tag and/or VIE) x known Lyons Ferry FH fish
    - adipose-fin clip-only x known Lyons Ferry FH fish
    - Unmarked/untagged x known Lyons Ferry FH fish.

- Broodstock collection and spawning protocol are complicated because not all hatchery fish are identified by marks or tags. Current protocols are followed to reduce the potential for incorporating stray hatchery fish and increase the inclusion of natural-origin fall Chinook. Approximately 70%-80% of the Snake River fall Chinook production released throughout the basin are marked and/or tagged in some manner.

- Comanagers are investigating alternative marks, including thermal otolith marks, which could be applied to 100% of the Snake River hatchery fall Chinook production. WDFW claims that thermal marks can be analyzed in real time to identify hatchery fish during spawning.

- Currently, Lyons Ferry females can be mated with a Lyons Ferry hatchery-origin male or an unclipped natural-origin male.

- Mating occurs in a 1 x 1 cross.

- One ocean males less than 57cm fork length (called jacks) are incorporated into the broodstock at a level not to exceed 15% of the adult males collected. No fish less than 45 cm are included in the broodstock.

- Males may be split and used on multiple females if needed.

- To maximize the incorporation of natural-origin Snake River fall Chinook in broodstock, all unmarked/non coded-wire tagged fish are scanned for PIT tags. Natural-origin Snake River fall

[45] *Pers. comm. W. Connor, USFWS, 2009.*

Chinook are beached seined above Clarkston, WA and PIT tagged. If it is determined the fish is natural origin, then they are used in spawning.

- Currently, due to lack of PIT tag equipment, not all males can be scanned for PIT tags prior to spawning. All females are scanned before spawning and males are scanned after spawning.

- Surplus Snake River adult fall Chinook (currently only hatchery origin) are returned to the river to continue their upstream migration. The surplus fall Chinook trapped at Lyons Ferry FH are returned to the river upstream of Lyons Ferry. These Chinook are externally marked to ensure they do not compromise run reconstruction efforts at Lower Granite Dam. Surplus fall Chinook trapped at Lower Granite Dam are returned to the river upstream of Lower Granite Dam, between Lower Granite Dam and the Clearwater River confluence. All adults trapped at Lower Granite Dam with coded-wire tags are retained for sampling and run reconstruction.

- Adult fall Chinook enter a ladder at Lyons Ferry FH that terminates in a trap. The trap is checked daily, possibly more often, depending upon expected return. Fish are directed by an automated crowder to a chute where they are identified by species and either returned to the river or directed to the appropriate pond where they are to be held until spawning.

- Fall Chinook collected at Lower Granite Dam are held separately at Lyons Ferry FH from those that are trapped at the hatchery.

- Fall Chinook collected at Lower Granite Dam are injected at capture with oxytetracycline and erythromycin (20 mg/kg fish) at Lower Granite Dam before transfer to Lyons Ferry FH. The fish collected from Lower Granite receive a second injection of erythromycin one month before spawning.

- Fall Chinook collected at Lyons Ferry FH ladder are injected with erythromycin (20 mg/kg fish) at sorting, up to 25 days after collection. Once spawning starts, newly trapped fish are injected at the next spawn day (up to seven days after trapping).

- All fall Chinook are treated with formalin (167 ppm) every other day to control fungus.

- Prior to spawning, all personnel disinfect raingear and boots before entering the spawn building.

- All females contributing to yearling production are tested for bacterial kidney disease (BKD) using the enzyme-linked immunosorbent assay (ELISA) technique. Fish are sampled across the run. For brood year 2004, females from the second through the fifth spawning weeks were sampled with 98% testing as "below-low" by ELISA. Progeny from these females were used in the yearling programs and progeny from all other females were utilized in the subyearling programs. From 1991 to 2008, only 105 of 12,145 females (<1%) sampled had BKD at high levels (>0.4 optical density) by ELISA.

- Sixty females used for broodstock are sampled to detect viral pathogens. Segregation and/or culling of progeny from virus positive females is not done.

- All adult fall Chinook are held in concrete raceways. One pond holds the new arrival fish trapped at Lyons Ferry FH. After they have been sorted through the spawning room and injected with erythromycin, the Chinook are moved to the second pond. The third pond holds fish hauled from Lower Granite Dam. After the Lower Granite fish are sorted through the spawning building the

first time, they are placed in the fourth pond. In 2009, the fall Chinook adult holding ponds were split from four to eight, resulting in a change to this protocol.

- During weekly spawning activities, fish are crowded into a channel, enter an elevator, are hoisted into the building and submerged in anesthetic, and then placed on the sorting table. Ripe Snake River origin fish (hatchery and natural) required for that day's spawning are killed and spawned.

- Adult fish are anesthetized with MS-222.

- Adults released as yearlings dominate the broodstock due to higher survival rates and a higher proportion of elastomer tags. As of 2008, efforts have been made to minimize the number of yearling males used in matings. CWTs and elastomer tags are read prior to spawning to differentiate between yearling and subyearling released males to ensure that subyearling males contribute to the broodstock.

Incubation and Rearing

- Fertilized eggs are water hardened for one hour in 100-ppm iodophor, and incubated in vertical stack incubators.

- Progeny from females rated as "below-low"(<0.1 optical density by ELISA) for BKD are used for the yearling programs. Progeny of "low", "moderate", and "high" BKD-ELISA and untested females can be utilized in the subyearling fall Chinook program. These fish are distributed among all subyearling releases when possible.

- When available and according to priority, "eggs" from "below-low" and "low" ELISA females are selected for transfer to Oregon and Idaho programs.

- Eggs are reared in the vertical incubators, and are treated with formalin (1,667 ppm, for 15 minutes daily), beginning 24 hours after fertilization and halting at 7 days before hatch to reduce fungus. Each tray is loaded with approximately 5,000 eggs. The incubation room is designed to accept and incubate eggs from individual females through the eyed stage.

- Eggs are shocked at eye-up, around 550 temperature units (TU's), and handpicked shortly thereafter. After eggs are picked, folded Vexar sheets are added to each tray for substrate.

- Each female are kept separate until eye up. After eyeing is complete and ELISA and virus sample results are received, eggs are combined, according to sample results, and placed in trays with substrate.

- The natural-origin fish used in matings are incorporated into all release groups. This is managed at the egg stage.

- Head troughs providing well water to the incubators are alarmed, and visual inspections of flow through the trays along with head trough levels are conducted daily.

- Formalin treatments stop just before hatch. After complete yolk-sac absorption by hatched fry (at around 1900 TU's), they are transferred to raceways for rearing.

- Lyons Ferry FH production fry are moved to outside raceways at ~1,600 fish per pound. In addition to standard raceways, since 2003, the adult raceways have been used to rear subyearling

fish destined for transfer to acclimation and release sites managed by the Nez Perce Tribe (Captain Johns, Pittsburgh Landing, and Big Canyon acclimation facilities). By utilizing these larger ponds, densities in other raceways are dramatically reduced. Fish rearing densities are very low (≤0.10 lbs/ft^3).

- Initial rearing of fall Chinook occurs in outside raceways, 10ft wide x 100 ft long x 2.8 ft deep, which run 600 gpm of well water.

- After fish reach fingerling size, the on-station yearling production group fish are marked and placed into one of Lyons Ferry FH's three 2.1-acre rearing lakes. The fish will remain in the lake until release.

- Fish health practices follow the Pacific Northwest Fish Health Protection Committee's Model Comprehensive Fish Health Protection Program (Pacific Northwest Fish Health Protection Committee Approved September 1989, revised February 2007). Fish are examined monthly for health and as needed.

- Bacterial gill disease (BGD) has occurred in recent years at Lyons Ferry FH and is possibly related to significant increases complexity of the programs and production. The BGD problem is similar to that encountered during the initial years of operation at Lyons Ferry FH, when extremely high numbers of subyearling fall Chinook were propagated. In late December 2004, Chinook in the yearling program were diagnosed with BGD and treated with potassium permanganate (1.0 ppm, 8 hours drip for 3 days) and increased water flow. The estimated loss to BGD was 16,000 fish or 3.5%. Fish recovered and were healthy at release in spring 2005. BGD also occurred in subyearling fall Chinook reared in one raceway in 2005. These were successfully treated with chloramine-T at 10 ppm in a 1 hour drip for three consecutive days. In 2008, BGD was identified in the juveniles held in the adult ponds, and it has shown up in the lakes.

- The current density index for fall Chinook subyearlings at or smaller than 100 fish per pound does not exceed 0.08 as a result of disease concerns. Density values can increase on a sliding scale to a maximum value of 0.14 for yearlings at 10-12 fish per pound. These density index goals were developed to improve fish quality and survival.

- Fry/fingerling are fed an appropriate commercial dry or semi-moist trout/salmon diet. Fry are initially fed 8 or more times per day. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance with good fish culture practices and program goals.

- Fall Chinook designated for the yearling releases and the subyearling releases from Captain Johns, Pittsburgh Landing, and Big Canyon acclimation facilities are given a 28 day prophylactic treatment using feed treated with erythromycin in June of their first year to reduce the potential for Bacterial Kidney Disease (BKD) outbreaks. In the years 2001 to 2004, clinical signs (pustules in kidney) and moderate to high levels of BKD as measured by ELISA were significant in the yearling juveniles in pre-release exams done by the Idaho Fish Health Center. From 2005 to 2008, there have been no clinical signs of BKD in the yearlings; however, low levels of BKD were detected by ELISA during regular monitoring in 4 to 42% of the yearlings at the acclimation sites.

- The subyearlings are not treated with erythromycin and can be progeny from females with higher titers of BKD. At release from Lyons Ferry FH and the acclimation sites, BKD levels are low (as measured by ELISA) and the prevalence has progressively declined since 2005 (from 22% to 1.5%).

- De-scaling and lack of parr marks are notable in the yearlings released from Lyons Ferry FH and the acclimation sites.

- From 2003 to 2006, infectious hematopoietic necrosis virus (IHNV) has been detected in the pre-release exams done on the subyearling and yearling juveniles at the Big Canyon Acclimation site although no mortality was noted. Fish are at the acclimation sites long enough to pick up infections from anadromous salmonids in their river water supply. Enteric redmouth disease caused some mortality at this site in 2007.

- The parasite Nucleospora salmonis has been detected the fall Chinook yearlings at Lyons Ferry FH and at the Big Canyon Acclimation Site. Sampling was done in 2008, 2009 at Lyons Ferry FH and from 2007-2009 at Big Canyon. In 2009, the subyearlings at were sampled. The significance of this finding remains to be determined. In the Hagerman Valley, this parasite is immunosuppressive and responsible for increased mortality and disease issues. Recently, there is evidence that the parasite may be transmitted vertically.

- A program change was implemented in 2007 which includes 421,000 eyed eggs from Lyons Ferry FH transfer to Oregon Fish and Wildlife (ODFW) for rearing at the Irrigon Hatchery (identified as priorities 13 and 16). Marking and tagging will occur there as well. These fish are released into the Grande Ronde River in Washington as subyearlings by ODFW.

Release and Outmigration

- Fish release groups do not represent egg takes across the run because the size variability at time of tagging is too high to tag each release group as one lot. Two egg takes are sequentially rotated through release groups annually to compensate for this.

- A total of 200,000 subyearlings are 100% coded-wire tagged and adipose-fin clipped in April for release from Lyons Ferry FH into the Snake River in early June. At release, these fish are pumped from the raceway using a four or six inch Aqua-Life® fish pump. The fish are directed through an irrigation pipe to the Snake River. Staff monitor the hydrograph in low flow years to ensure that the Chinook are released during higher period and when the dams are spilling.

- Pre-release exams for the subyearlings and yearlings going to the Nez Perce managed acclimation sites consist of tests for virus, bacteria, *Myxobolus cerebralis, Nucleospora salmonis* and *R. salmoninarum* (for BKD) and are done by the Idaho Fish Health Center at Lyons Ferry FH. At the acclimation sites, the IDFHC also visits and tests fish health throughout juvenile rearing, including frequent monitoring for BKD, and performs pre-release exams (60 fish tested for virus, *N. salmonis*, bacteria and *R. salmoninarum)* approximately one week prior to release.

- As needed, formalin is used to treat and control tail rot and external parasites at Big Canyon Acclimation site.

- Subyearlings are transported in May to acclimation facilities on the Snake River (Captain John Acclimation Facility- 500,000, Big Canyon Acclimation Facility -500,000 , Pittsburg Landing - 400,000). These fish are acclimated and released in June by the Nez Perce Tribe. An additional 200,000 subyearlings may be direct-stream released into the Snake River at Couse Creek, near Captain John Rapids. These fish are part of a study to compare survival of fish released directly versus those acclimated prior to release. The Lyons Ferry FH staff coordinate with the Nez Perce Tribe to assure that the direct-stream release will correspond with the Captain John acclimated release, scheduled for June.

- Oregon Department of Fish and Wildlife (ODFW) will also direct-stream release 400,000 subyearlings into the Grande Ronde River near the Washington border. They are transferred to Irrigon Hatchery from Lyons Ferry FH as eyed eggs, reared and tagged there, then released into the Grande Ronde River in Washington in early June. The co-managers will coordinate exact release location and timing.

- A yearling release of 450,000 fish from Lyons Ferry FH directly into the Snake River at 10 fish per pound is programmed for a volitional release over a three day period from Lake Two into the Snake River between April 1 and April15. Since all three lakes share a common release structure, the fall Chinook release must be coordinated with steelhead releases. Screens and stop logs are pulled around April 1 to allow fish to volitionally move to the outlet structure. The outlet structure is a concrete raceway approximately 11 ft wide x 59 ft long x 4 ft deep (total depth without water). Fish move out of this channel to the Snake River.

- Three yearling groups are marked and/or tagged at Lyons Ferry FH in September 2009, then transferred to Captain John, Big Canyon, and Pittsburg Landing acclimation sites (at ~ 12 fish per pound) for final rearing and release by Nez Perce Tribe in April 2010 at a target of 10 fish per pound.

- Lyons Ferry FH adds salt to the water in the transport tank when shipping fall Chinook but not when shipping steelhead or rainbow trout. Salt is added at 0.5% by weight (50 lbs/ 1,200 gallons of water).

- The steelhead are released on-station shortly after the fall Chinook release.

Facilities and Operations

- There are separate holding and spawning facilities for fall Chinook and steelhead.

- All adult fall Chinook are currently held in 4 raceways that are approximately 18 ft wide by 150 ft long with a water depth of 4.3 ft. In 2009, funding was approved by the Northwest Power and Conservation Council to divided the fall Chinook adult holding ponds into eight 9 ft by 150 ft raceways. The additional pond units will allow fish trapped at Lower Granite Dam and transported to the hatchery, and adults that voluntarily swim into the facility, to be segregated by run-timing, sex, origin and sexual maturation. The additional ponds are intended to reduce the need to crowd fish, handle and sort fish by maturity status at Lower Granite Dam and as such decrease fish stress.

- The incubation room at Lyons Ferry FH is designed to accept and incubate eggs from individual fall Chinook females through the eyed stage. The south side incubation room holds four banks of 28 stacks, which hold 1,568 usable Heath trays. Each 8 tray half stack has its own water source. Only 7 trays are used for incubating with the top tray used as a settling tray. Water is single-pass flow through the incubation stacks at about 4.5 gallons per minute. The water temperature is 51-53 degrees F.

- The incubation building is fitted with back-up pumps to maintain flow through the trays in emergency situations, and with secondary packed columns to maintain water oxygenation above 10 ppm. Flow monitors will sound an alarm if flow through the incubation troughs is interrupted.

- There are 47 outdoor raceways available for rearing at Lyons Ferry FH. 28 raceways are 10’x100’ (600 gpm maximum) and 19 are 10’x88’ (1000 gpm maximum).

- Lyons Ferry FH has three 2.1-acre rearing lakes. The three large lakes receive 3,500 – 4,200 gpm total providing a good flow with no hydraulic problems. These large ponds limit flexibility to produce small groups of fish, commonly required for restoration and recovery programs. .

- Water is supplied to Lyons Ferry FH from the Marmes pump station, which has emergency power backup generation. There are eight deep wells at the site that produce nearly constant 52^0 F, fish pathogen-free water. The hatchery is permitted to pump up to 53,000 gpm (118.1 cfs). The Marmes pump (wells) facility has three 300 horsepower (hp) pumps, four 200 hp pumps and one 75 hp pump. The well water right for Lyons Ferry FH is 53,200 gallons per minute (gpm), or 118.5 cubic feet per second (cfs) of flow, and water temperature is a relatively constant 52 F.

- Water supply at Marmes site has remained stable for many years.

- Lyons Ferry FH cannot utilize their total water right. Staff believe that mineral accumulation (i.e. manganese) in the line from the pumping station to the facility is likely constricting water availability.

- From December-early March, during peak production, pump failure (especially one of the 300 hp pumps) combined with the constrained water line could result in fish loss.

- High concentrations of dissolved Manganese (variable among the eight wells. but especially high in Well #4 since it is shallower than the others), and particulate Manganese Oxide, is strongly suspected of limiting the density at which fall Chinook can be reared in raceways at Lyons Ferry FH. While the water also has higher concentrations of other minerals (common in deep wells), no negative impacts on eggs or fish from these are known.

- There is no water source alternative to the Marmes pump station.

- Water flow and low water alarm systems, and emergency generator power supply systems to provide incubation and rearing water to the facilities are installed at Lyons Ferry FH. All pumps are now fitted with automatic restart systems in case of power outages.

- The Army Corps of Engineers currently holds the water right.

- Although this facility reports water flow in its Monthly Discharge Monitoring Reports as a requirement for its NPDES Permit, water diversions are not adequately measured and reported to meet Service standards for documenting beneficial use and state standards for annual reporting.

- All outside rearing units, except for the adult holding ponds and intermediate circular tanks (which are both at times used for juvenile rearing), are covered with netting to exclude birds. All rearing lakes at Lyons Ferry FH were covered with netting in 2003-2004 to prevent excessive bird predation.

- Predator fencing is not used but mammal predation is not considered a major problem. At times, traps are used under a permit to remove otters. Additionally, bird netting around the lakes reaches the ground, which likely deters some predation.

- Discharge from Lyons Ferry FH complies with all NPDES standards. Fall Chinook spawning effluent is routed to the offline pollution abatement pond.

- The hatchery has a sophisticated alarm system and read-out screen. Some onscreen outputs for flow are erroneous. They have also experienced false alarms on occasion. The alarm system requires constant maintenance (i.e. cleaning probes) to reduce the instances of erroneous readouts and false alarms.

- An emergency action plan to maintain flow in the incubation room was developed by Lyons Ferry FH and is implemented in case of emergency. Egg incubation room water supply is alarmed. Portable pumps are available to pull water from outside raceways into incubation room during power failure at Marmes pump station. Employees carry digital pagers after hours for alarm response. Because of the complexity of the hatchery and its program, an alarm situation requires two employees to respond.

- The hatchery has undergone a Service safety review to indicate safety problems and hatchery staff indicated they have a backlog of needed safety improvements. For example, a number of catwalks in and around spawning/sorting area lack appropriate safety handrails and fall protection.

- The roof on the fall Chinook spawning building is leaking and needs to be replaced.

- Nursery rearing space at Lyons Ferry FH is limited. Hatchery staff have indicated that the location where the intermediate circular tanks are located could be covered and adjusted to provide additional early rearing space.

- There no shade covers over the raceways.

- Lyons Ferry FH has maximized its production capabilities, restricting program increases or additions. Demands are increasing for rearing multiple stocks at Lyons Ferry FH that is limited in flexibility given that the hatchery is designed with fewer, larger rearing vessels (e.g. three large lakes, early rearing troughs, etc.). Lyons Ferry FH is a production hatchery, and as such, the raceways were not designed for small group rearing. The hatchery's design also limits the facility's ability to utilize aspects of natures rearing, such as in-pond structures, shade covers, in-water feeders, etc). However, WDFW is investigating alternatives for improving the rearing environment. Modifications to the facility to use natural rearing techniques may be cost inhibiting.

Research, Education, and Outreach

- A total of 200,000 subyearlings are 100% coded-wire tagged and adipose-fin clipped in April for release from Lyons Ferry FH into the Snake River in early June. Fall Chinook subyearlings released on station are not currently PIT tagged. WDFW has proposed PIT tagging the on-station subyearling release, and have calculated that they would need to PIT tag 48,000 based on SAR's to obtain adequate adult return data.

- Captain John Acclimation Facility receives 500,000 subyearlings from Lyons Ferry FH in May, as does Big Canyon Acclimation Facility. Both groups are comprised of 100,000 coded-wire tag, 100,000 adipose-fin clip + coded-wire tag, and 300,000 unmarked fish. Pittsburg Landing will receive 400,000 subyearlings in May. This group is comprised of 100,000 coded-wire tag, 100,000 adipose-fin clip + coded-wire tag, and 200,000 unmarked fish. All marking and tagging is completed by WDFW in March and April, prior to transfer. Pit tagging may occur prior to and/or post transfer to acclimation sites. These fish are acclimated and released in June by the Nez Perce Tribe. Prior to release, the Nez Perce Tribe will PIT tag 2,500 fish at Big Canyon, 2,500 fish at Pittsburg Landing, and 3,500 fish at Captain John to be compatible with the direct stream released fish out planted at Couse Creek.

- A unique coded-wire tag code is used for each release group.

- All of the 200,000 subyearlings that may be direct-stream released into the Snake River at Couse Creek, near Captain John Rapids are adipose-fin clipped and coded-wire tagged. 3,500 are PIT tagged.

- Of the 400,000 to be direct-stream released into the Grand Ronde by ODFW, 200,000 fish are adipose-fin clip + coded-wire tag marked (*US v Oregon priority 13*), and 200,000 are unmarked and untagged. WDFW will randomly PIT tag 3,500 fish from this release.

- A yearling release of 450,000 fish from Lyons Ferry FH directly into the Snake River at 10 fish per pound is programmed for 2010. All of these fish were marked and/or tagged during September 2009 (225,000 adipose-fin clip, coded-wire tag and elastomer tag by left eye, and 225,000 coded-wire tag and red elastomer tag by left eye), and transferred into Lake Two. A portion of these fish are PIT tagged (as many as 30,000) at the same time to better estimate escapement of adults through the hydro system to Lyons Ferry FH, Lower Granite Dam, and the Tucannon River. Those fish receiving a PIT tag will not be elastomer tagged.

- Three yearling groups were marked and/or tagged at Lyons Ferry FH in September 2009 (adipose-fin clip and coded-wire tag or coded-wire tag only; and up to 57,000 PIT tags—see release table in the "Objectives" section above for a breakdown by release group), then transferred to Captain John, Big Canyon, and Pittsburg Landing acclimation sites (at ~ 12 fish per pound) for final rearing and release by the Nez Perce Tribe in April 2010 at a target of 10 fish per pound. Prior to release, Nez Perce Tribal staff PIT tag 4,000 fish at each site for emigration timing and survival through the hydro-system. This tagging is coordinated with the Army Corps of Engineers transportation study. If Army Corps of Engineers transportation tagging does not occur tagging will be conducted at the acclimation sites.

- An initiative is being developed among LSRCP comanagers to standardize monitoring and evaluation and create a standardized data management system for data entry and reporting.

- A study is being performed by the University of Idaho, School of Fisheries, extracting otoliths from adult Chinook and comparing them to juvenile progeny to quantify the variability in the otolith signature at Lyons Ferry FH.

- Approximately, 840 tourists visit Lyons Ferry FH annually.

- Lyons Ferry FH has a visitors' center with signs describing salmon life-history, the Snake and Columbia River basin environment, and hatchery production.

- Staff work with three local schools as part of salmon in the classroom projects. School groups tour the facility annually.

- Lyons Ferry FH/WDFW cosponsors fishing derbies in ponds adjacent the Tucannon River and in Clarkston.

- The facility has no volunteer program.

- The USFWS maintains a web site with the goal to provide timely information to the public regarding hatchery operations and program benefits.

- WDFW does not have a web page describing Lyons Ferry FH and its programs.

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[46] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- In 2008, Idaho conducted a fall Chinook harvest season on the Snake River, the first season in decades. The season opened October 3, 2008 on the Snake River from Lewiston upstream to Hells Canyon Dam and ended Friday, October 31, 2008. Anglers caught and kept 132 marked adult and jack fall Chinook in the Snake, and they released 409 adult and jack salmon during 21,749 hours of angler effort. Hatchery-origin fish were marked with a clipped adipose fin.

- Washington conducted a fall Chinook harvest season on the Snake River from the Railroad Bridge crossing the Snake River about a half mile downstream of the mouth of the Tucannon River upstream to the no fishing zone below Little Goose Dam, plus from the safety zone boundary above the dam up to the boat launch approximately 1 mile upstream of Little Goose Dam (along the south shore). The season opened from September 25, 2008 through Oct.15, 2008. This was the first fall Chinook fishery for adult salmon retention in decades in the Snake River and it is being used as a test fishery for planning for potential future fall Chinook fisheries. Washington reported 9 fall Chinook harvested and 32 fall Chinook released during the season.

- Nez Perce tribal harvest in the Clearwater River reported 52 fall Chinook taken in the Clearwater River during 2008.

Conservation Benefits

- Total adult returns from the hatchery program back to the Snake River have increased substantially in recent years from less that 1,000 hatchery-origin fish each year, 1983-1996, to over 10,000 fish each year, 2001-2008. Returns of natural-origin adult fall Chinook have similarly increased from less than 1,000 fish each year, 1976-1998, to a range of 2,273-6,630 adults per year, 2000-2008. As a consequence, the program appears to be conferring a significant demographic and conservation benefit.

- The hatchery program serves as a demographic buffer and potential genetic reserve for the naturally spawning population.

Research, Education, Outreach and Cultural Benefits

- Ongoing hatchery evaluation of rearing protocols, disease histories, feed conversion, and growth and survival rates are used in adaptive management feedback loops to improve hatchery operations. The information is also communicated to the fisheries community and greater public through scientific and management forums.

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[46] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*

- Coded-wire tag data provides information regarding contribution to fisheries. PIT tag data provides juvenile and adult survival information through the Columbia River Basin dams and can be used for in-season harvest adjustments based on adult detections at the dams.

- Evaluations of annual hatchery and natural escapement allow for assessments of stock status and progress toward recovery of the ESU.

- Tribal harvest and surplus adults trapped at facilities provide a cultural and subsistence benefits to Columbia River tribes.

- Fall Chinook juveniles are used to evaluate the efficacy of downstream barging.

- A study being conducted by the USFWS, WDFW and the Nez Perce Tribe evaluates the merit of direct stream releases of fall Chinook subyearlings versus acclimated releases.

- Lyons Ferry FH staff cosponsor fishing derbies and provide educational opportunities to school groups and other visitors.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[47] the Review Team identified the following benefits of this program:

Harvest Benefits

- Lyons Ferry FH fall Chinook contribute to ocean and Columbia River sport, commercial and tribal fisheries. Locations and contributions (expanded to reflect total take)of Lyons Ferry fall Chinook in 2006 from fish released by WDFW include 1,054 in the Columbia River (313 in the below Bonneville sport fishery, 208 in the below Bonneville non-treaty gillnet fishery, and 533 in the Bonneville to McNary treaty gillnet fishery) and 1,790 in the ocean fishery (3 in the Alaska sport fishery, 32 in the Alaska troll fishery, 2 in the Alaska purse seine fishery, 213 in the British Columbia sport fishery, 799 in the British Columbia troll fishery, 85 in the high seas troll fishery, 201 in the Washington sport fishery, 63 in the Washington troll non-treaty fishery, 243 in the Washington treaty troll fishery, 6 in the Washington treaty drift gillnet fishery, 24 in the Oregon Sport fishery, 113 in the Oregon troll fishery, and 6 in the California troll fishery).

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Hatchery and evaluation staffs provide educational opportunities offsite to other communities.

- Results of the ongoing transportation study contributes to the body of research regarding downstream barging of juvenile salmon and steelhead.

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[47] *Ibid.*

- Tribal harvest and surplus adults trapped at facilities provide a cultural and subsistence benefits to Columbia River tribes.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[48] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- Inclusion of unmarked stray hatchery fall Chinook from outside the Snake River Basin (e.g. Umatilla) into the broodstock jeopardizes the genetic reserve benefit of the program.

- Inability to capture adequate numbers of natural-origin fall Chinook for inclusion into the hatchery broodstock poses a domestication risk.

- Inability to segregate within population broodstock sources (Clearwater River, and upper and lower Snake River) to develop locally adapted broodstocks within the existing Snake River basin population impedes establishment of spatial structure and diversity.

- The high proportion of hatchery-origin fall Chinook spawning naturally, could impede recovery of a naturally spawning population if the proportion is not reduced over time.

- Restricting on station releases to fall Chinook representing a narrow temporal portion of the egg takes poses genetic risks to the Lyons Ferry fall Chinook stock.

Demographic Risks

- A recovery plan consistent with the TRT's designations could inhibit management strategies designed to maximize the spatial structure and recovery of fall Chinook populations in the Snake River downstream from Hells Canyon complex.

- The facility is dependent upon the continuous operation of pumped well water, increasing the risk of catastrophic loss. Pumped well water is the exclusive water source for the facility.

- High concentrations of dissolved manganese in the well water (especially in the shallow well, number 4) poses a fish health risk to fall Chinook and may contribute to the incidence of Bacterial Gill Disease.

- The accumulation of manganese precipitate restricts flow and water conveyance reducing the rearing capabilities of the facility over time. Manganese accumulation in the main water line reduces overall water availability. Accumulation in the smaller pipes can constrict water flow to individual rearing units.

- Fish are not easily released from the facility in an emergency, increasing the risk of catastrophic loss.

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[48] *Ibid.*

- The water alarm does not function properly which could lead to fish loss.
- Lack of shade covers over the ponds concentrates fish in shaded areas along walls during summer months, increasing densities, potential stress, and disease risks
- Crowding and loading in association with transportation to release sites may physically harm the fish, which may be contributing to increased post-release mortality.
- Transportation to release sites poses a demographic risk to the stock during transport and unknown physiological (stress) risks during transport and following release.
- Trapping and hauling fish from Lower Granite Dam poses a demographic risk of handling at the dam and transportation to Lyons Ferry FH.

Ecological Risks

- Bacterial Gill Disease and BKD periodically occur, posing a fish health risk.
- *Nucleospora salmonis* may also affect fish health.
- Release of large numbers of hatchery fall Chinook juveniles into multiple locations for supplementation within the Snake River Basin on top of naturally spawning populations poses a competition risk to natural-origin juvenile fall Chinook.
- Ecological risk from antibiotic resistance in bacterial flora within the system from erythromycin injections and prophylactic use of medicated feeds for hatchery-reared fish, and antibiotics in effluent.

Physical Risks

- A number of identified safety issues associated with the adult trap and collection facility (e.g. catwalks and railings) have not been addressed, posing a human safety risk to hatchery staff. The spawning area at Lyons Ferry FH is also crowded and may pose a human safety risk during collection, injection, sorting, and spawning of fall Chinook.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[49] the Review Team identified the following risks from the hatchery program:

Genetic Risks

[49] *Ibid.*

- Genetic risks to the Hanford Reach fall Chinook population outside of the Snake River Basin are unknown but assumed to be small based on the small number of coded-wire tag recoveries in the Hanford Reach from Lyons Ferry FH.

Demographic Risks

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in raceways that are over loaded.

Ecological Risks

- The amplification of disease within the hatchery poses a risk of disease transmission to Snake River and downstream fish populations and the risk of vectoring disease in the region.

- Lyons Ferry fall Chinook are susceptible to BKD and BGD. *Nucleospora salmonis* may also be an issue.

- The collection and barging of fall Chinook smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program[50]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue LF-FC1: At the present time, fall Chinook in the accessible portions of the Snake River are managed as one single stock or population. In the long term, this will inhibit the development of spatial structure and diversity for naturally spawning populations (aggregations) of fall Chinook in the Snake River. *The Snake River fall Chinook ESU was reduced to a single remnant population, largely maintained by Lyons Ferry FH. As a result of the successes of the current program, the abundance of Snake River fall Chinook in recent years has increased substantially from a few hundred fish in the mid 1990's to close to 20,000*

[50] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

fish in recent years. The increased abundance has increased the abundance of fish representing, but the current management strategy does not address the viability parameters of spatial structure and diversity.

Recommendation LF-FC1: Establish natural spawning escapement goals for the major spawning aggregates in the Clearwater River, Snake River between the mouth of the Salmon River and Hells Canyon Dam, and the Snake River below the mouth of the Salmon River. Correlate the number of fish released (direct and acclimated) with the natural spawning escapement goals for each of those major spawning aggregates. Establishing a sliding scale that would reduce the number of hatchery fish released for supplementation within each natural spawning aggregate as natural escapement goals are achieved.

Issue LF–FC2: The purpose of the current fall Chinook program is to provide mitigation as specified under the LSRCP program while meeting the interim conservation and recovery criteria established for the Snake River fall Chinook ESU. *The mitigation goal is to return 18,300 fish to the project area. Comanagers have identified general short-term and long-term natural-origin spawning goals for the entire ESU (7,500 and 14,360, respectively[51]). However, short and long term adult escapement goals have not been established for specific natural spawning areas associated with current release locations. Additionally, specific harvest goals have not been established for each release location.*

Recommendation LF-FC2a: Establish specific natural-origin spawning escapement goals consistent with release strategies (numbers and locations) and conservation and recovery criteria developed for Snake River fall Chinook.

Recommendation LF-FC2b: Establish specific harvest goals that are associated with current release strategies and consistent with natural-origin spawning escapement goals for conservation and recovery.

Issue LF-FC3 There is not an established Snake River fall Chinook ESU recovery plan that provides guidance for the existing Lyons Ferry FH fall Chinook program*. US v. Oregon does address production and harvest levels for the Lyons Ferry fall Chinook program and comanagers have developed a draft Snake River Fall Chinook Management Plan; however, an official, agreed-to recovery plan does not currently exist.*

Recommendation LF-FC3: Comanagers should complete a recovery plan that identifies how Snake River fall Chinook recovery should be achieved.

Broodstock Choice and Collection

Issue LF-FC4: The current management goal that natural-origin fall Chinook compose 30% of the broodstock (pNOB = 0.30), provided that this number does not exceed 20% of the natural-origin spawning population, is not achievable in most years under current conditions (2,273-6,607 natural-origin returns 2002-2007). *Approximately 3,500 adult fall Chinook must be retained for broodstock of which approximately 1,050 natural-origin fish are necessary to achieve pNOB equal to 0.3. The number of natural-origin fish required for*

[51] *Draft Snake River Fall Chinook Management Plan.*

broodstock would exceed 20% of the natural-origin adults passing Lower Granite Dam in most years under current conditions.

Recommendation LF-FC4a: Broodstock management should focus on collecting broodstock at a rate that does not exceed 20% of the natural-origin spawning population and allow the pNOB value to vary among broodyears depending upon the abundance of natural-origin adults available for broodstock**.**

Recommendation LF-FC4b: The Review Team supports comanager efforts to achieve a pNOB value = 30%, which is expected to reduce domestication risks, by trapping natural-origin fall Chinook adults at Lower Granite Dam. The likelihood of achieving this target could be increased by improving the broodstock collection and sorting capabilities at Lower Granite Dam.

Issue LF-FC5a: Managing the proportion of natural-origin fall Chinook to be incorporated in the broodstock pNOB is complicated because not all hatchery fish are identified by marks or tags. *Only 70% to 80% of the Lyons Ferry fall Chinook receive marks and/or tags. This poses a domestication risk to the propagated stock since those hatchery-origin fall Chinook that don't receive a mark or tag cannot be distinguished from natural-origin fall Chinook and could be included as natural-origin fish in the broodstock.*

Issue LF-FC5b: Managing the proportion of hatchery origin recruits (pHOS) on natural spawning and rearing areas above Lower Granite Dam requires the ability to trap, identify, and live sort migrating adults. *The proportion of hatchery fall Chinook marked by methods identifiable in live fish and the limited proportion of returning adults that can be examined and sorted at Lower Granite and other existing traps precludes effective sorting.*

Recommendation LF-FC5: Mark or tag all hatchery-origin fish in some manner so that they can be distinguished from natural-origin fish during broodstock collection. Consider using a marking method or methods which can be distinguished while the fish are alive to allow monitoring and sorting for passage to natural spawning areas as well as broodstock collection (see recommendation LF-FC14 regarding improvements to the Lower Granite trap).

Issue LF-FC6: While the yearly fall Chinook on station releases represents the majority of the egg takes, the subyearling fall Chinook released on station and transfers to the FCAP represent only a few spawn takes. *Progeny from two egg takes are used in many of the release groups. The egg takes are rotated through release groups annually. This is performed because tagging across all egg takes for each release group is difficult due to the high variability in fish size. This results in an effective number of breeders that is less than 50% of the total number of adults spawned for some of the release groups. Restricting on station releases to fall Chinook representing a narrow temporal portion of the egg takes each year is a form of artificial selection and poses genetic risks to the Lyons Ferry fall Chinook stock..*

Recommendation LF-FC6: Utilize eggs from adults across the entire run and spawn takes for the on-station release. Consider chilling eggs to equal out temperature units among egg takes and ultimately reduce size variability at the time of marking and tagging.

"Maximize the contribution from each egg take to represent the entire run for each of the release groups. Consider manipulating incubation temperatures to equal out temperature

units among egg takes and ultimately reduce size variability at the time of marking and tagging."

Hatchery and Natural Spawning, Adult Returns

Issue LF-FC7a: The current management strategy of collecting broodstock at Lower Granite Dam and Lyons Ferry FH, and then releasing the progeny of those fish in the Clearwater River and Snake River below Hells Canyon, prevents the long-term development of spatial structure, diversity, and local adaptations of both hatchery and naturalized populations in those latter two, major spawning aggregate areas. *For example, comanager agreements under the US v Oregon process assigns low priority of egg transfers to Oxbow FH, although Oxbow FH is a location where a local broodstock for the Hells Canyon reach of the Snake River could be developed. The long-term practice of capturing broodstock at Lower Granite Dam, and then releasing the progeny of those fish at upstream locations (i.e., Clearwater River and lower Hells Canyon) with different temperature profiles and hydrologies, limits natural selection or selective advantage for adult Chinook that do return to the specific areas of their release. In the long run, the current strategy is expected to inhibit optimization of smolt-to-adult return rates (SARs) back to the release locations, increase stray rates between the spawning aggregates, and reduce the mean productivity (recruit per spawner) of fish that do reproduce naturally in the two respective aggregates. Ideally, broodstock should be collected from returning adults within the spawning aggregates where they were released as juveniles and where natural spawning supplementation is desired. The development of locally adapted broodstocks and naturally spawning aggregates for the Clearwater River and the Hells Canyon reach of the Snake River could contribute to increased spatial structure and diversity, thereby assisting with meeting management goals and objectives of the remaining Snake River fall Chinook population. Local adaptations that maximize productivity can only develop if adult fish are allowed to return to the areas where they were released or originated as juveniles, and then successfully reproduce and produce progeny in the same areas where their parents reproduced successfully.*

Recommendation LF-FC7: Explore opportunities for recapturing adult fall Chinook at within the upper Snake and Clearwater spawning aggregates (Nez Perce Tribal Hatchery and Oxbow FH) for developing local broodstocks for the Clearwater River and the Hells Canyon reach of the Snake River, respectively. Localized broodstocks developed at the two sites would then be used to produce fall Chinook for harvest and to supplement the Clearwater River and Hells Canyon reach of the Snake River. Continue to maintain an integrated program utilizing adult returns to Lyons Ferry FH and Lower Granite Dam for release of juveniles at Lyons Ferry FH to help meet LSRCP mitigation goals and harvest goals for the lower Snake River, to serve as a genetic reserve for Snake River fall Chinook, and to provide a source of fish for developing two localized stocks for the Clearwater River and the Hells Canyon reach of the Snake River, respectively. In particular, the Nez Perce Tribal Hatchery may be the appropriate place for developing an "early-run" fall Chinook population for the Clearwater River. Developing such a population is a long-term goal of the Nez Perce Tribe.

Issue LF-FC8: The current management strategy is to pass hatchery-origin fall Chinook adults upstream of Lower Granite Dam with the intent to reestablish naturally spawning populations, irrespective of the number being passed. *This may be desirable as the initial phase of restoring naturally spawning populations as a first step toward recovery of the ESU.*

Recommendation LF-FC8: As the number of natural-origin adult recruits' increases over time, the number of hatchery-origin fish spawning naturally should decrease to allow the establishment of viable, self-sustaining naturally spawning populations. Ultimately, this might require the development of a sliding scale for the number of hatchery-origin fish allowed to pass upstream of Lower Granite Dam**.** Modifications to the Lower Granite Dam collection and sorting facility (see recommendation LF-FC14) and/or improvements to mainstem collection sites downstream of Lower Granite (e.g. Ice Harbor) may be required to achieve this objective.

Issue LF-FC9: The current practice is to return any Lyons Ferry hatchery-origin adults not needed for broodstock, monitoring, or run reconstruction to the Snake River to "supplement" the natural population.

Recommendation LF-FC9: Concurrent with the future objective of establishing viable, self-sustaining naturally spawning populations, discontinue returning hatchery-origin adults to the Snake River**.**

Issue LF-FC10: Lyons Ferry FH fall Chinook are periodically used to backfill other fall Chinook programs.

Recommendation LF-FC10: Discontinue backfilling other fall Chinook programs. If backfilling does occur, ensure that Lyons Ferry FH fall Chinook are differentially marked so that they are not included in the backfilled program's broodstock.

Incubation and Rearing

Issue LF-FC11: The fall Chinook reared at Lyons Ferry FH periodically experience outbreaks of Bacterial Gill Disease which can result in substantial losses to a broodyear*. Reductions in rearing densities achieved by utilizing the adult holding ponds have reduced outbreaks; however, mortalities have still reached 3.5% since the rearing modification was made. Theraputic treatment is required. Most of the bacterial gill disease occurs in the raceways although it can occur in the lakes (a bacterial gill disease outbreak only occurred once in 14 years of rearing fall Chinook in the lakes). Fish size (less than 35 fish per pound) at time of movement between the raceways and the lakes and manganese in the water supply are hypothesized to increase susceptibility to the disease. Rearing densities are currently low and not thought to be a contributing factor, but the complexity of the program and fish distribution practices at the hatchery may favor bacterial infections when fish are most susceptible*.

Recommendation LF-FC11: Investigate modifying hatchery practices to reduce or eliminate the incidence of Bacterial Gill Disease. Consider adjusting feed frequency or amounts, investigating flow patterns and turnover in lakes for modifications of water flow, increasing aeration in the lakes, and improving cleaning methods in the raceways**.** May need to consider resizing the yearling and subyearling programs**.**

Issue LF-FC12: Juvenile fall Chinook that are released as yearlings are given a medicated feed to help control bacterial kidney disease. *These treatments are given prophylactically (i.e. when the fish do not show clinical signs of disease). The U.S. Department of Agriculture and other federal agencies have published warnings and advisories regarding the biological risks and potential overuse of antibiotics. However, BKD is annually detected in the fall Chinook juveniles at Lyons Ferry FH and the acclimation sites, indicating that antibiotic treatment*

may be necessary to control this disease if the fish are reared to the yearling stage. At release, the yearling fish show de-scaling and a loss of parr marks, indicators of physiological maturity/stress. Propagation of fall Chinook beyond the stage of smoltification increases their susceptibility to BKD.

Recommendation LF-FC12: Re-evaluate the need for regularly scheduled prophylactic use of erythromycin feed with the goal of phasing out its use. Included in this phase-out could be a study that evaluates adult returns from erythromycin treated and untreated juvenile groups.

Release and Outmigration

Issue LF-FC13a The natural life history of fall Chinook in the Snake River includes the outmigration of juveniles to the ocean as sub-yearlings or as yearlings after over-wintering in fresh water or the Columbia River estuary. *Currently, natural-origin Chinook from the Snake River commonly enter the ocean as subyearlings, whereas juveniles from the Clearwater River commonly enter the ocean as yearlings. The majority of hatchery-origin fall Chinook are currently released as subyearlings; however, fall Chinook are released into the Snake River as yearlings at three locations: Lyons Ferry FH (200,000 fish), Pittsburg Landing (150,000 fish), and Captain John Rapids(150,000 fish). In addition, fall Chinook are released as yearlings at one location in the Clearwater River: the Big Canyon facility (150,000 fish).It is unclear whether the current strategy of releasing a proportion of each brood year as yearlings confers any net benefits with respect to meeting the stated goals of the program.*

Issue LF-FC13b: Fall Chinook salmon released as yearlings are held in the hatchery and acclimation sites beyond the natural physiological stages of smoltification and outmigration for this species*. Signs of stress and maturation are detected by de-scaling and loss of parr marks during fish health pre-release exams done at Lyons Ferry FH and the three acclimations sites. At the acclimation sites, the yearlings are held for several months and can be infected by pathogens such as IHNV and enteric redmouth disease, transmitted from migrating adult salmonids in the river water supply. When water conditions become less favorable at the acclimation sites, the fish can show increased mortality due to pathogens. Prior to 2005, bacterial kidney disease (BKD) was significantly worse among pre-release yearling juveniles subyearling juveniles until stringent BKD prevention techniques (erythromycin injections of adults, use of progeny from low BKD female parents, and use of medicated feed) and improved fish culture (low densities) reduced disease progression. However, low levels of BKD have been detected since 2005 in 4 to 42% of the yearling fish during the five-month rearing period prior to release.*

Issue LF-FC13c: Adult return rates for fall Chinook released as yearlings are, at the present time, approximately twice (2x) return rates of fish released as subyearlings. *This ratio was > 10x during the early 1990's when return rates were much lower. Substantially more fish could be reared if all fish were released as subyearlings.*

Issue LF-FC13d: The acclimation facilities (Captain John's, Pittsburgh Landing, and Big Canyon) have problems with intake water supplies and back-up power generation that require highly trained personnel during emergency situations*. Fish in the yearling program are on site for 2.5 –3 months, just before the subyearling program Chinook which are on site for 6-8 weeks.*

Recommendation LF-FC13: Assess the overall benefits and risks of releasing a proportion of each brood year as yearlings versus releasing all fish as subyearlings, These evaluations

should include considerations of the natural life history strategies of fall Chinook in areas where hatchery fish are released to determine if current yearling release levels and locations are consistent with program goals and the current life history strategies of natural-origin fall Chinook in the Snake and Clearwater rivers. If the benefits of releasing fall Chinook as yearlings do not significantly outweigh the risks, consider terminating the yearling program and increase the number of subyearlings released to achieve the LSRCP mitigation goal of the program. Determine if increases in the subyearling program would continue to meet the necessary densities and/or environmental conditions required for healthy production at Lyons Ferry FH and the acclimation sites. Use of a lake for rearing subyearlings could be investigated to reduce densities. The goal would be to establish acclimations of 6-8 weeks so that time in the acclimation sites is reduced, thereby decreasing exposure to pathogens, reducing operational time and exposure to limiting water conditions at the acclimation sites.

Facilities/Operations

See Lyons Ferry Steelhead for additional Facilities/Operations issues and recommendations.

***Issue LF-FC14: The adult collection and sorting facility at Lower Granite Dam is inadequate as a broodstock collection site for the fall Chinook program to meet current program objectives. During years when** large numbers of steelhead and hatchery-origin fall Chinook return to Lower Granite Dam facility constraints, stress associated with handling large numbers of fish, and water temperatures limit managers ability to collect and sort broodstock to meet program objectives (trap up to 20% of the run, incorporate up to 30% natural origin fish into the broodstock, and not trap when temperatures exceed 70 degrees F). As a result, based on the current run size projections for steelhead and fall Chinook in 2009 only 12% of the fish ascending the ladders at Lower Granite Dam will be targeted for interception and sorting resulting in a likely integration of only 6%-8% natural origin fish into the broodstock). The Lyons Ferry FH fall Chinook adult holding ponds are being modified in 2010 (dividing the four ponds into eight). This modification will allow more fish trapped at Lower Granite Dam to be safely handled at the facility.*

Recommendation LF-FC14: Consult with the Army Corps of Engineers and comanagers to modify the collection facilities at Lower Granite Dam to allow sorting a high proportion of fall Chinook in the presence of large numbers of steelhead passing at the same time. Facility modifications would also allow for the future management of hatchery-origin fish passage upstream of Lower Granite Dam (pHOS).

Issue LF-FC15: Lack of shade covers over the raceway increases crowding of fish, particularly during the summer months, potentially increasing stress and disease risks to the fish reared on station.

Recommendation LF-FC15: Consider constructing covers over the raceways.

***Issue LF-FC16: The accumulation of manganese precipitate in the water supply lines restricts flow and water conveyance, reducing the rearing capabilities of the facility over time**. Manganese precipitate has been observed in hatchery manifold lines which has resulted in constricted water flow and subsequent line replacement. It is presumed that this precipitate is accumulating in the main water line which could eventually reduce overall water availability. High concentrations of dissolved manganese in the well water also poses a fish health risk to*

fall Chinook and may contribute to the incidence of Bacterial Gill Disease. The shallowest well (number 4) is considered the largest contributor of manganese. (The Hatchery Complex Manager reported to the Review Team that recent work to rehab well pump number 5 found heavy accumulation of manganese precipitate on the pump shaft and spyder casing. In addition, he stated that they have purchased a water testing kit to monitor manganese in the water supply).

Recommendation LF-FC16: Consult with Service engineers to investigate modification of water chemistry to preclude formation of precipitate. In addition, consider deepening well number 4. Determine whether accumulated manganese precipitate can be removed from the main water line or if sections must be replaced, and remove or replace smaller pipes that are constricted.

Issue LF-FC17: Although the hatchery has a sophisticated alarm system, the alarm does not function properly and at times provides false or erroneous information which could lead to fish loss.

Recommendation LF-FC17: Service the alarm system and/or consider upgrading the system so that it functions properly**.**

Issue LF-FC18: Pumped well water from the Marmes pump station is the exclusive water source for the facility, increasing the risk of catastrophic loss to fish reared on station. Lyons Ferry FH's rears several out-of-basin stocks at the facility. There are risks associated with the loss of these fish on station and/or releasing these stocks into the mainstem Snake River.

Recommendation LF-FC18: Develop a contingency plan to address the loss of the water supply. This should include prioritization of stocks and plans for emergency transportation or direct release into the Snake River. ODFW should investigate the possibility of installing a backup pump system that would draw water from the mainstem Snake River.

Issue LF-FC19: The Lower Snake River Compensation Plan office is reviewing the ownership status of water rights associated with all comanager-operated facilities which divert water for fish culture. *In the case of Lyons Ferry FH, the water right is currently held by the Army Corps of Engineers. The appropriate documentation to transfer the water rights to the Service may not have been filed in the respective state agency that administers water rights. Moreover, facility staff may not consistently or adequately record water use to ensure documentation of beneficial use in support of its water right(s) and as required by state law. Adequate documentation and reporting are required to maintain the right to divert water.*

Recommendation LF-FC19: Complete transfer of the water right from the Army Corps of Engineers to the U.S. Fish and Wildlife Service. WDFW should work with the Lower Snake River Compensation Plan office to ensure water diverted for fish culture is measured and reported correctly. Water use information needs to be maintained by the Service's, Region 1 Engineering, Division of Water Resources.

Issue LF-FC20: The roof of the fall Chinook spawning building leaks.

Recommendation LF-FC20: Repair the roof of the fall Chinook spawning building.

Issue LF-FC21: A number of safety issues were identified at Lyons Ferry FH during a Service safety review but have yet to be corrected), posing a human safety risk to hatchery staff*. The Service has performed a safety review of Lyons Ferry FH. Issues that were identified and not yet corrected include catwalks and railings for the fall Chinook adult trap and collection facility.*

Recommendation LF-FC21: Contract or hire temporary maintenance staff to correct safety issues.

Research, Monitoring, and Accountability

Issue LF-FC22: Fall Chinook subyearlings released on station are not currently PIT tagged. *WDFW has proposed PIT tagging the on-station subyearling release, and have calculated that they would need to PIT tag 48,000 based on SAR's to obtain adequate adult return data.*

Recommendation LF-FC22: PIT tag the subyearlings at the recommended rate.

Issue LF-FC23a: Information is limited regarding the proportion of hatchery and natural-origin fall Chinook spawning naturally. *Proportions of hatchery versus natural origin fall Chinook migrating upstream are monitored at Lower Granite Dam; however, spawning ground surveys in natural production areas have been difficult.*

Issue LF-FC23b: Little is known regarding differential reproductive success of natural-origin versus hatchery-origin recruits in natural spawning and rearing areas.

Issue LF-FC23c: Juvenile hatchery-origin fall Chinook may pose competition and predation risks to natural-origin fall Chinook, but little or no information is presently available to evaluate this.

Recommendation LF-FC23: Increase monitoring of adult hatchery and natural interactions on the spawning grounds and juvenile interactions in the rearing habitat. Consider a structured evaluation of differential reproductive success of hatchery and natural origin recruits spawning in the Snake River above Lower Granite Dam.

Issue LF-FC24: A consistent mechanism for dealing with contingencies that are not covered in management documents or through the Annual Operation Plan process appears to be lacking*. The comanagers meet on an annual basis to agree upon program actions; however, if contingencies arise, there is no apparent, agreed upon process to discuss and reach agreement. Additionally, management documents designed to facilitate contingency planning, such as HGMPs or Statement of Works (SOWs), are not updated on a regular basis, and, in the case of HGMPs, have not been approved which means a formal ESA consultation process has not been completed for salmon and steelhead.*

Recommendation LF-FC24: Continue to work with the comanagers to establish such a consistent mechanism, such as within the AOP process and including the finalization and approval of all HGMPs.

Issue LF-FC25: The evaluation and dissemination of sampling data for LSRCP programs is inadequate, inhibiting the ability for managers to make decisions based on current

information. *There exists a backlog of annual reports. The LSRCP office has increased staff and has begun reducing the backlog. However, reporting is not yet timely enough.*

Recommendation LF-FC25: Continue work through the backlog of annual reports. Complete annual reports in a timely fashion (e.g. within one year of the previous year's work).

Issue LF-FC26: The evaluation and dissemination of sampling data are inadequate, inhibiting the ability for managers to make decisions based on current information. *Data reporting does not meet the specified standards of the Pacific Salmon Commission.*[52] *Those standards require preliminary reporting of data for the current calendar year no later than January 31 of the following year" reference.*

Recommendation LF-FC26: The Service should work with LSRCP comanagers to develop a data management plan that incorporates tagging goals and objectives, data management, and reporting requirements of coded-wire tag data at both the program and regional levels. The Service should incorporate reporting requirements of coded-wire tag data into the cooperative agreement between the LSRCP office and comanagers (WDFW and tribes).

Education and Outreach

Issue LF27: The Lyons Ferry FH displays and handouts are outdated. *The existing Lyons Ferry FH displays were installed in the 1980's-early 90's when the facility was constructed.*

Recommendation LF27: Update the displays and handouts so that they accurately reflect the present state of salmon and steelhead and the associated programs at Lyons Ferry FH.

Issue LF28: The information available to the public in regards to the Lyons Ferry FH and its associated programs is inadequate. *The LSRCP web site lacks information for public consumption. Additionally, WDFW does not currently manage a web page for Lyons Ferry FH.*

Recommendation LF28: Information in regards to the harvest and conservation benefits the programs provide should be made available by the Service and WDFW in a format for public consumption (e.g. simple brochures, interactive web pages, etc.). For example, fishery benefits provided by the program for each hatchery could be updated annually on the LSRCP web site and provided in a brochure at the hatchery. This information should include contribution of hatchery-origin Snake River fall Chinook to marine fisheries in Canada and Alaska. If the LSRCP web site is the primary source of information for the program, any WDFW page for Lyons Ferry FH should be linked to this site.

[52] *Pacific Salmon Commission's Data Standard Work Group. December 2005. Specifications and Definitions for the Exchange of Coded-Wire Tag Data for the North American Pacific Coast. PSC Format Version 4. Regional Mark Processing Center, Portland, OR. www.rmpc.org.*

Alternatives to Current Program

The Review Team considered the benefits and risks of the existing fall Chinook program at Lyons Ferry FH and developed four alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

Alternative 1: Current program with recommendations

Numbers of fish released should be associated with well defined comanager supplementation and natural spawning escapement goals and objectives for the spawning aggregates within the Lower Snake River mainstem population.

Pros

- Maintains gene bank for Snake River fall Chinook.
- Provides fall Chinook for mitigation harvest opportunities.
- Provides adult hatchery spawners to supplement natural spawning populations until supplementation and natural spawning escapement goals and objectives are met.
- Maintains a high priority for reducing demographic risk in the one remaining fall Chinook population until at least one of the two extirpated fall Chinook populations within the Snake River MPG required for recovery are available for natural production.
- Allows for reductions in pHOS as natural production increases to meet comanager goals and objectives.
- Explores opportunity to develop a localized broodstock for the Clearwater and Hells Canyon portions of the Snake River population.
- Explores potential for providing localized adult hatchery spawners to supplement natural spawning populations until natural spawning escapement goals and objectives are met.
- Can reduce risks associated with maintaining population gene bank at one facility (Lyons Ferry FH) and emphasizes the development of Nez Perce Tribal Hatchery and Idaho Power portions of the program for additional broodstock collection and rearing.
- Allows for reductions in pHOS as natural production increases to meet co-manager goals and objectives.
- Maintains a high priority for reducing demographic risk in the one remaining fall Chinook population until at least one of the two extirpated fall Chinook populations required for recovery are available for natural production.

- Provides fall Chinook for mitigation harvest opportunities.

- Increases the long-term viability of the Lower mainstem Snake River population.

Cons

- Inhibits localized broodstock development within natural spawning aggregates of the Lower Mainstem Snake River population.

- Maintains emphasis on broodstock collection and rearing at Lyons Ferry FH rather than developing Nez Perce Tribal Hatchery and the Idaho Power portions of the program.

- Will not lead to recovery of Snake River fall Chinook (need two of three populations within the MPG).

- Does not address recovery of Snake River fall Chinook (need two of three populations within the ESU).

- Reduces the potential harvest opportunities in the Snake River until natural production goals and objectives are achieved on a regular basis.

Alternative 2: Develop an early returning stock of fall Chinook for the Middle Fork Clearwater River upstream from the North Fork Clearwater River as an alternative to reintroducing fall Chinook upstream of Hells Canyon Dam

Manage fall Chinook as four populations versus three, but manage a Clearwater population that has unique life-history characteristics. Establish two stocks of fall Chinook in the Clearwater Basin. This is considered a method for attempting to speed up the evolution for a fall stock that potentially existed in the Clearwater basin. The Nez Perce Tribe's oral history describes a stock of Chinook that spawned in the Middle Fork Clearwater in early fall. Spawning salmon and extensive Indian fisheries were described in the Journals of Lewis and Clark at the time the expedition was camped at "Canoe Camp" just upstream of the confluence of the North and Middle Forks in early October 1805. This stock of salmon was apparently extirpated by the WWP dam at Lewiston in the early 20th century. The Nez Perce Tribe has proposed to reestablish the "early-spawning fall Chinook" life history by selectively rearing the earliest spawners at Nez Perce Tribal Hatchery and Lyons Ferry FH and releasing the progeny in the Middle Fork, lower South Fork and lower Selway rivers.

Pros

- Potentially adds an additional and unique spawning aggregate to the SRFC ESU and allows the ESU to develop additional diversity (or to express diversity that currently exists)

- Increases the distribution of the SRFC ESU into habitat that is currently not occupied.

- Increases the abundance of naturally produced SRFC.

- Increases productivity by utilizing suitable, but vacant, habitat.

- Contributes to recovery of the Snake River Fall Chinook by increasing the diversity, distribution, abundance, and productivity within the ESU.

- If successful, contributes to the LSRCP mitigation goal.

- Restores traditional Tribal fishing opportunity.

- Contributes to recreational and commercial fisheries.

- Tests the concept of using artificial propagation to accelerate adaptation to the unique temperature and hydrographic conditions of the Middle Fork.

Cons

- Although artificial selection has changed spawning and return timing of some hatchery populations, the concept of using artificial propagation to adjust the spawn timing of a naturally producing population has not been tested.

- Spawn timing changes induced in the "early spawning" component would not be desirable and could have a negative survival impact on the other spawning aggregates within this ESU.

- Production allocated to development of an early-spawning component could, in the short term, reduce the number of fish available for harvest mitigation.

Alternative 3: Reallocate program priorities to include the release of fall Chinook upstream of Hells Canyon Dam in the extirpated Marsing Reach and/or Salmon Falls population's historic spawning and rearing areas.

Include the release of fall Chinook salmon upstream of Hells Canyon Dam as a high priority. This alternative puts equal priority on meeting the LSRCP mitigation goal and recovery of the ESU as prescribed by the ICTRT. This alternative requires extensive habitat restoration in the area upstream of Hells Canyon Dam.

Pros

- Would meet the recovery criteria for the Snake River fall Chinook population set forth by the ICTRT.

- Continues to support LSRCP mitigation goals.

- Maintains harvest opportunities for Snake River fall Chinook.

Cons

- Historic spawning and rearing habitat for the Marsing Reach and Salmon Falls populations is severely limited (e.g. poor water quality, impoundments, flow and temperature issues, water diversions, exotic predatory fish species, etc).

- Extensive investment to modify infrastructure for upstream and downstream migration/passage, including trap and haul facilities.

- Requires relicensing of Hells Canyon Dam and possibly other dams to address habitat and passage issues.

Alternative 4: Terminate the program and decommission the facility

Decommission hatchery in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site.

Pros

- Significantly reduces the proportion of hatchery-origin fall Chinook returning to the Snake River.

Cons

- Eliminates the gene bank program for Snake River fall Chinook.
- Eliminates harvest mitigation of Snake River fall Chinook.
- Eliminates the priority for reducing demographic risk of extinction of Snake River fall Chinook.
- Does not directly address the need to reestablish two of the three populations within the Snake River fall Chinook MPG, required for the population group to be considered recovered.

Recommended Alternatives

The Team recommended Alternative 2, to develop an early returning stock of fall Chinook for the Middle Fork Clearwater River upstream from the North Fork Clearwater River as a near-term alternative to reintroducing fall Chinook upstream of Hells Canyon Dam to meet ICTRT recovery criteria. This recommendation is intended to be implemented consistent with all recommendations in Alternative 1. This alternative would be to develop management goals and objectives for four major spawning aggregates within the Lower Snake River Mainstem fall Chinook population. The intent is; 1) to fully implement the Nez Perce Tribal Hatchery program to provide a localized broodstock sources for release and acclimation in the mainstem Clearwater River between the North Fork Clearwater and the Snake River, 2) fully implement the IPC Hells Canyon program to provide a localized broodstock sources for release and acclimation in the Snake River between Hells Canyon Dam and the Salmon River, 3) explore the feasibility to develop an early-returning fall Chinook broodstock program to provide a localized broodstock sources for release and acclimation for the Clearwater River above the North Fork Clearwater, and 4) continue to collect broodstock at Lower Granite Dam and Lyons Ferry FH for the Lyons Ferry program to maintain a Lower Snake River Mainstem fall Chinook population reserve that would be used to maintain LSRCP mitigation harvest in the Snake River and as a reserve to seed the entire population if natural production were to collapse to levels experienced in the mid-1990's.

The Team's recommendation was intended to expand on the current success of the initial supplementation of the entire Lower Mainstem Snake River population with the existing broodstock source taken at Lower Granite Dam and Lyons Ferry FH, and to develop localized broodstock sources within four major spawning aggregates in the remaining Snake River fall Chinook population to increase diversity within the population while regional managers continue to develop a final recovery strategy that based on ICTRT criteria would need to include at least one of two extinct populations

above the Hells Canyon complex. The Team's recommended alternative was also meant to be consistent with the intent of the current *US v. Oregon* agreement.

The Team's recommendation was based on the recent success of the existing supplementation program to return adult spawners back to the Snake River and to use that success to develop specific management goals and objectives for the four major spawning aggregates to further increase diversity within the remaining Lower Snake River Mainstem Population while providing for increased harvest opportunities for state and tribal fisheries. Given that only one population within the Snake River fall Chinook ESU currently remains, the Team was concerned that the continued use of a single broodstock source collected at Lower Granite Dam and Lyons Ferry FH and released throughout the entire population would, under the current large numbers of natural and hatchery returns, reduce the long-term diversity within the naturally spawning population aggregates. The Team also believes that this alternative would also increase potential harvest and production benefits consistent with the intent of the current *US v Oregon* agreement.

The Team also recognizes that the recommendation will require considerable time and facility investments to fully develop and implement the programs at Nez Perce Tribal Hatchery and IPC's Hells Canyon.

While the Team also considered reallocating production above the Hells Canyon complex (Alternative 3) to be consistent with the ICTRT recovery recommendations, we realized that such actions will require extensive planning, costs, and a large number of logistics to be overcome prior to such actions being taken and were beyond the near-term reality of being implemented. The Team also felt that our recommended alternative would be consistent with any potential actions that may be taken in the future to address ICTRT recovery recommendations.

The Team did not recommend Alternative 4, given the long-term needs to continue to conserve Snake River fall Chinook and to meet the management intent of the states and tribes under the current *US v Oregon* agreement.

Tucannon River Spring Chinook

Operator: Washington Department of Fish and Wildlife

Summary of Current Program

Goals

- ***Harvest goal:*** There is no stated harvest goal at the present time. However, the total adult mitigation return goal under the LSRCP program is to return 1,152 spring Chinook to the Tucannon River. Of those returning adults, approximately 170 adults are required for broodstock at Lyons Ferry FH and the remaining fish are available to supplement the Tucannon River population.

  If successful, this programs primary purpose will be to provide harvest mitigation in the Tucannon River as originally designed under the LSRCP program. There is potential for subsistence harvest in tribal fisheries on all spring Chinook in the Columbia and Snake river basins. However, there is currently no quantified "harvest" goal for this program separate from the return goals. Two sliding scales are being developed by WDFW to determine appropriate levels of harvest and escapement: one that does not include a mark-selective fishery and one that does. The sliding scales were included in the Fisheries Management Evaluation Plan submitted to NOAA in May, 2009 and are currently under review by NOAA.

- ***Broodstock escapement goal:*** Collect 170 spring Chinook adults (85 natural origin and 85 hatchery origin, and 50% male/50% female) including jacks not exceeding 15% of the adult males for broodstock.

- ***Conservation goal:*** Artificially maintain and/or increase numbers of naturally reproducing Tucannon River spring Chinook that successfully produce viable progeny which contribute to the conservation and recovery of the Tucannon River population and Snake River ESU.

- ***Escapement goal for natural-origin adults***: The ICTRT identified the Tucannon River spring Chinook as an intermediate sized population with a minimum interim abundance and productivity target for ESA-listed spring Chinook in the Tucannon River of 750 natural-origin spawners and 2.2 recruits per spawner, respectively. The interim recovery goal is 750 natural-origin adults and the interim restoration goal is 2,400 -3,400 natural and hatchery-origin adults (Snake River Salmon Recovery Plan) to the mouth of the Tucannon River (pers. comm. Glen Mendel)

- ***Research, education, and outreach goals:*** Determine whether the productivity of the natural-origin Tucannon population is maintained or improved through supplementation. Determine whether Tucannon spring Chinook can be used to reintroduce spring Chinook in Asotin Creek.

  Provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Lyons Ferry FH and LSRCP programs. The Dayton Lab monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex.

Objectives

- Collect 170 fish (85 females and 85 males) at the Tucannon weirs and transfer the adults to Lyons Ferry FH. Spawn the adults to yield 272,000 green eggs. Utilize 85 hatchery and 85 natural-origin fish with the goal of using 50% females and 50% males from each group. Incorporate a maximum of 15% jacks as a portion of the male spawners.

- Transfer 246,000 spring Chinook from Lyons Ferry FH to Tucannon FH at 30 fish per pound in September

- Transfer 227,000 spring Chinook from Tucannon FH to Curl Lake Acclimation Facility at approximately 12 and 18 fish per pound in February.

- Release 225,000 spring Chinook smolts at approximately 9 and 15 fish per pound into the upper Tucannon River from Curl Lake Acclimation Facility (river mile 40) in April.

- Pass hatchery progeny upstream to increase the size of the naturally spawning population.

- Estimate productivity of the naturally spawning population during supplementation.

Program Description

Lyons Ferry FH (Phase II) was constructed in 1984 under the LSRCP Program, as authorized by the Water Resources Development Act of 1976, Public Law 94-587, to offset losses caused by the four Lower Snake River dam and navigation locks projects. Lyons Ferry FH was designed to rear 8,800 pounds (142,000 smolts) of spring Chinook salmon (15 fish per pound) for release. The program was initiated with adult collections in 1985, however due to low adult returns in the mid-1990's a captive brood program was initiated concurrent with the existing mitigation program.

A 10 year captive brood program component was initiated in 1997 to prevent extirpation of the listed stock. It was designed to last only one generation (five brood years). This program concluded with the release of 2006 broodyear smolts in 2008. Returning adults trapped at the Tucannon FH comprise the conventional broodstock component. The conventional release goal was increased to 225,000 beginning with the 2006 brood year.

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- Natural and hatchery-origin Tucannon spring Chinook are utilized for broodstock.

- Spring Chinook are collected from April through September at the adult trap (river mile 59) located just upstream of Tucannon FH on the mainstem Tucannon River. The bulk of the run returns in May and June.

- Since the broodstock collection goal has increased from 100 to 170 (in 2006), broodstock collection goals have not been met. For 2006, 2007 and 2008, 36, 54, and 42 (average 44) natural-origin and 53, 34, and 92 (average 60) hatchery-origin spring Chinook were collected, respectively. In order to meet broodstock collection goals, WDFW is discussing adjusting the number of hatchery versus natural-origin fish used for broodstock.

- According to the section 10 permit for the program, if the total annual adult return to the Tucannon trap is predicted to be less than 105 fish, then WDFW will retain all hatchery and natural-origin Tucannon spring Chinook salmon. If the total annual adult returns to the trap are 105 fish or more, WDFW is authorized to retain up to 70 percent of that total and release the remaining 30 percent for natural spawning. This protocol is being revisited by WDFW in 2009.

- Jacks are included in the brood at a rate not to exceed 15% of the adult males although this rate may be exceeded during low run years. This increased limit is necessary to meet the new release target of 225,000 yearling smolts.

- Tucannon spring Chinook, as part of the Snake River spring/summer Chinook ESU, are listed as threatened under the Endangered Species Act.

- There is currently no approved recovery plan for listed Snake River spring Chinook**.**

Hatchery and Natural Spawning, Adult Returns

- Tribal harvest occurs in the lower Columbia River (zone 6). Incidental take occurs in non-tribal commercial and sport fisheries in the ocean and in the lower Columbia River.

- In the Tucannon subbasin, spring Chinook are mainly restricted to portions of the mainstem Tucannon River. Spawning occurs in the Tucannon River from the mouth of Sheep Creek (RM 52) downstream to King Grade (RM 21). Although a very limited amount of spawning has been documented in lower Panjab Creek, spawning is rarely observed in any other Tucannon River tributary.

- Based on coded-wire tag data, there have been some summer Chinook hatchery strays recovered in the lower part of the Tucannon River. Stray rates vary by year. From 1990-2008, 0-13.6% (mean = 3.3%) of the spring Chinook returning to the Tucannon River were strays. 0-12.1% (mean=2.7%) of the spring Chinook returning to the Tucannon River were Umatilla spring Chinook.

- There has not been a comprehensive review of the ecological health of the Tucannon River watershed in relation to salmonid population status and recovery. Limiting factors such as water temperature, channel stability, sediment, and instream habitat are known to exist in the basin, but the extent of these problems is un-quantified.

- Information on the historical distribution and abundance of Tucannon spring Chinook is not available, although the Tucannon Subbasin Plan cites an estimate of 30,000 adult spawners in the Tucannon River prior to 1916 and approximately 5,000 in the 1950s. Based on the EDT analysis in the subbasin plan (Section 4.0), the historical capacity and adult abundance ranged from 12,215

to 12,688, the current capacity and adult abundance was estimated at 235 to 712, and under an improved habitat scenario (Properly Functioning Conditions) the capacity and adult abundance was 1,769 to 2,412. The run averaged 316 natural-origin fish annually between 1985 and 2002.

- WDFW states that habitat has improved significantly in the Tucannon River since the 1980s although the lower 40 kilometers of the river were still temperature limited for spring Chinook in 2007. WDFW estimates that improving riparian cover and channel morphology in the Tucannon River mainstem would increase Chinook-rearing capacity present in the early 1980s by a factor of 2.5. Habitat restoration efforts should increase habitat utilization by spring Chinook salmon in the marginal sections of the Hartsock and Marengo strata of the Tucannon River and increase fish survival.

- Based on the 2007 annual spring Chinook report, WDFW has identified that a significant portion (approximately 53%) of the returning PIT tagged spring Chinook (both hatchery and natural-origin) bypassed the Tucannon River and were detected at Lower Granite Dam. Domestication influence is considered less of a factor since both hatchery and natural-origin spring Chinook appear to stray above lower Granite at relatively the same rate (57.1% for hatchery origin and 50.0% for natural origin).

- In 2007, approximately 76.7 % of the estimated hatchery-origin and 56.6% of the estimated natural-origin Tucannon spring Chinook returns were trapped at the Tucannon FH trap.

- All unclipped spring Chinook that not retained for broodstock, regardless of whether they are unmarked hatchery-origin or natural-origin, are passed upstream. All adipose-fin clipped spring Chinook are considered strays and killed at the trap. From 1986-2007, an average of 88 hatchery-origin and 94 natural-origin spring Chinook were passed above the weir.

- The HSRG estimated that hatchery-origin spring Chinook composed an average of 47% of the naturally spawning population in the Tucannon River (*pHOS* = 0.47).

- Approximately 1/3 of the primary spawning area for Tucannon spring Chinook is below the Tucannon FH weir.

- The Tucannon River spring Chinook salmon population declined significantly in 1994 and 1995, reducing the population to only 54 adult fish. In response to this decline, WDFW collected the majority of the run in 1995 for hatchery broodstock in an effort to maximize survival and maintain the population.

- Except for two years in the 1960s, non-native, hatchery-reared spring Chinook have not been released in the Tucannon River. The Klickitat and Willamette were the two non-native hatchery stocks released in these years.

- Spawning ground surveys have occurred annually in the Tucannon River since 1985. The surveys occur on a weekly basis during the spawning period. All of the primary spawning areas are surveyed.

- While the use of local broodstock lessens the risk to the natural population to some degree, natural-origin fish comprised only 38 percent of the natural escapement from 1998 to 2002.

- From 1985-2008, there were on average 133 redds (range 5-299) in the Tucannon River.

- From 1985-2008, the estimated escapement to the Tucannon River was a mean of approximately 500 adults (54-1,191). Of those spring Chinook, a mean of 312 (range 3-718) were natural-origin adults and a mean of 214 (range 19-658) were hatchery-origin adults.

- Based on broodyears 1985-2002, the approximate smolt-to-adult return rate for the natural and hatchery population is 1.48% and 0.22%, respectively.

- The recruit per spawner for the natural population is 0.56% (geometric mean) and less than one in most years. The HSRG estimated the recruit per spawner for the hatchery population as R/S = 3.0 based on generalized assumptions

- Tucannon River spring Chinook adults collected for broodstock are transferred by truck to Lyons Ferry FH for holding and spawning. The adults are held in 52 to 54 degree well water at Lyons Ferry FH. The low water temperatures help minimize pre-spawning mortality. The spring Chinook are held in one steelhead adult holding pond.

- All adult and jack salmon captured and hauled for broodstock from Tucannon FH are transported in a stainless steel, 500 gal tank on the back of a flatbed truck. The tank is equipped with supplemental oxygen and aerators. Transportation time to Lyons Ferry FH is about 50 minutes. Up to 15 adults can be transported in the tank at one time.

- Maintaining an equal sex ratio in the spawning population is an objective of the hatchery program. Spawning protocols currently employ 2x2 factorial design[53] to increase the number of pairwise crosses and genotypic diversity among the progeny.

- All spring Chinook carcasses are frozen after spawning, and hauled to the upper Tucannon River for nutrient enhancement, if viral samples test negative.

- A representative number of fish are tested for virus. In 2006, 36 females and 36 males (?, KS) were tested.

- All adults are injected at least two times with erythromycin to prevent bacterial kidney disease (BKD). All female adults are tested for BKD using the enzyme-linked immunosorbent assay (ELISA). BKD levels are low in this population--only 5 of the 656 females tested from 1992-2007 had high levels (>0.45 OD) of BKD so there is no segregation or culling of the progeny.

- Adults are treated with formalin (167 ppm formalin drip) every other day prior to spawning.

- *Nucleospora salmonis* has been detected in the spring Chinook at Tucannon FH. No pathology was associated with this detection.

Incubation and Rearing

[53] In a "2x2 factorial" design, the eggs from each of two females are each partitioned into each of two aliquots of approximately equal proportion. One sub-lot from each female is fertilized my one male, and the other sub-lot from each female is fertilized by a second male. This protocol results in four, pairwise crosses of eggs and sperm (2 females x 2 males in a factorial or "matrix" design).

- The average fecundity for age-4 natural-origin Tucannon River spring Chinook is 3,400 and age 4 hatchery-origin Tucannon River spring Chinook is 3,000. Age 5 natural-origin Tucannon River spring Chinook is 4,300 and age 5 hatchery-origin Tucannon River spring Chinook is 3,600.

- After fertilization, eggs are rinsed and transferred to the vertical stack heath trays where they are water hardened in iodine solution (100 ppm) for one hour to control viral and bacterial disease.

- Vertical stack Heath trays are used for the Tucannon spring Chinook program. Up to 6 stacks of 14 trays are used. Flow through the stacks is about 3.5 gpm. Trays are stocked one female per tray (approximately 3,000-4,000 eggs). Individual trays allow for documenting fecundities and fertilization success of the different groups.

- Incubation, as with rearing, occurs in sediment free, 51-53 degree F (11 C) well water.

- Incubating eggs are treated with formalin every other day at 1,667 ppm (37% formalin) for 15 minutes to control fungus.

- After development to the eyed-egg stage, the eggs are shocked and dead eggs are removed. Substrate (layered plastic screening material) is added to the trays, and eggs from each female are placed back in their original tray. Eggs are allowed to hatch and sac fry rear in the trays until yolk absorption is complete.

- When the incubating fry (supplementation and captive progeny) have completely absorbed their yolk sac, they are ponded directly into the raceways. The raceways are partitioned by a screen to aid in initial feeding. The outdoor intermediate tanks may be used if there are small egg takes form 3 to 5 females. Those would be reared to a size large enough to consolidate with larger takes in the raceways.

- Six intermediate fiberglass rearing tanks were installed in 2006 to provide more space during early rearing to reduce rearing densities so that they would not exceed 0.15 DI. The intermediate tanks also allowed individual spawn groups to be grown together in size before mixing in outside raceways and allowed fish to be moved to the raceways at a much larger size, possibly increasing survival to release. Currently, these intermediate rearing tanks are not used for the program.

- In November-December, the spring Chinook are transferred to the standard raceways at Lyons Ferry FH (10 x 100 x 2.8 feet in water depth). Each raceway is supplied with 500-1,000 gal/min of well water at constant temperature. Up to 3 raceways are used for this program with a maximum flow index of 0.52.

- Raceways are cleaned weekly by brushing screens and vacuuming pond floors.

- Lyons Ferry FH guidelines for “early rearing” densities are not to exceed 0.15 DI to control BKD. These guidelines are followed. When the spring Chinook are reared in rearing ponds (Curl Lake), densities are very low, approximately 10% of the raceway maximum.

- Fry are initially fed eight or more times per day. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance program goals.

- Tucannon spring Chinook are transferred at approximately 30 fish per pound to Tucannon FH in September for final rearing and release. The Chinook are coded-wire and elastomer tagged about two weeks before transfer.

- At Tucannon FH, spring Chinook are reared in concrete round ponds or raceways on river water, except when well water is added mid-winter to maintain water temperatures near 40 degrees F. Depending on the number of fish transferred to Tucannon FH, fish are placed in a 15 x 136 x 4 feet in water depth raceway, two 10 x 80 x 3 feet in water depth raceways and/or in circular ponds (40 ft diameter x 2 feet in water depth). In early to mid-October, the Chinook are moved into the adult pond until release into Curl Lake.

- In an effort to eliminate the potential for gill disease the hatchery staff uses a vacuum system to clean the raceways. This method of cleaning results in less raceway sediments becoming suspended during cleaning.

- The maximum density and flow indexes for various concrete ponds at Tucannon FH are .11 DI in the raceways and .06 in the larger adult pond. FI in each of the units is approximately 0.88 and 0.67 respectively

- Survival: Green to eyed rate is 96%, eyed to hatch is 96%, fry to fingerling transfer to Tucannon FH 98% and 99 % from fingerling to release from Curl Lake.(average of the last 5 years.)

- One prophylactic treatment of aquamycin (erythromycin) is used to control BKD in the juveniles spring Chinook at Lyons Ferry FH. This treatment lasts 28 days, and is typically applied in July and August, through feed with 4.5% aquamycin. This is performed as a preventative measure as BKD is currently not an issue in the spring Chinook juveniles.

Release and Outmigration

- Fish are transferred to Curl Lake in mid-February (at approximately 12 and 18 fish per pound), and allowed 3-4 weeks of acclimation before the outlet of the pond is opened, allowing for volitional migration. Once the pond outlet screens are pulled, fish have about 4-5 weeks when they can leave the pond at any time. Generally, most of the fish don't exit the pond until April. During the final week of release, dam boards in the pond outlet are slowly removed to lower the pond. This generally encourages all remaining fish to leave.

- Checks for elastomer and coded-wire tag retention are conducted at Tucannon FH prior to transferring the fish to Curl Lake AP in February.

- In 2009, the large group was transferred at 16 fish per pound and the small group, 20 fish per pound.

- Density indexes within Curl Lake are very low with a DI of 0.005. Fish are fed by truck mounted feed blower.

- For 2009, the target release goal is 55,000@ 9 fish per pound & 59,000 @ 15 fish per pound (114,000 total). Fish are released at two different sizes as part of a size at release study (see description in the Research section below) .

- Only 60% of the smolts released from Curl Lake survive to the mouth of the Tucannon River.

- Survival components for natural-origin spring Chinook in the Tucannon River (brood years 1985-2005) have been estimated as: egg-to-parr = 10.1%, parr to smolt = 55.8%, and egg to smolt = 5.8%.

- Survival components for hatchery-origin spring Chinook in the Tucannon River (brood years 1985-2005) have been estimated as: egg to parr = 84%, parr to smolt = 87.3%, and egg to smolt = 72.6%

Facilities and Operations

Lyons Ferry FH

- There are three ponds used for adult holding that are 83x10 with a water depth of 5 feet. Adult steelhead are held in 2 ponds and spring Chinook and/or Touchet and Tucannon stock steelhead in the third pond. These adult holding raceways are enclosed over the middle one-third of the raceway length by the spawning building, where spawning occurs.

- A catastrophic power and water system delivery failure may require release of spring Chinook into the Snake River at Lyons Ferry FH.

- Discharge from Lyons Ferry FH complies with all NPDES standards. However, steelhead and spring Chinook spawning effluent are discharged directly into the Snake River.

See Lyons Ferry Fall Chinook section for additional information regarding Lyons Ferry FH Facilities and Operations

Tucannon FH

- The Tucannon FH adult trap was constructed in 1998 after floods in 1996 destroyed the previous trap. The new trap is located at the intake diversion dam and includes a ladder system around the dam. The ladder can be opened to allow unrestricted passage if necessary. Trap efficiency is highly dependent on springtime flows. Plastic flaps were added to the top of the trap's weir/intake diversion dam in 2008 to help restrict upstream passage of adults when flows are high.

- The ladder at the trap is left open October-January to allow for unrestricted passage of fish populations.

- At Tucannon FH, raceways are supplied with oxygenated well or river water from the hatchery's central degassing building. Approximately 1,000 gpm (2.2 cfs) water enters raceway (15 x 136), 400 gpm (0.9 cfs) enters raceways (10 x 80), and 200 gpm (0.45 cfs) enters the round ponds.

- Oxygen levels range between 10-12 ppm entering, to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Flow index (FLI) is monitored monthly and rarely exceeds 80% of the allowable loading. The flow index is about 1.5 at Tucannon FH.

- Tucannon FH is supplied with three different water sources. River water is fed from the Tucannon River, and ranges in temperature from 33 to 60 degrees F, during use by the hatchery. The intake is located one half mile upstream of the hatchery. This water travels down an open channel into the man-made Rainbow Lake. From the outlet of Rainbow Lake the water travels through an 18" above ground pipeline to the hatchery. This pipeline was completely replaced in 2005. Rainbow Lake functions as a reservoir to provide the hatchery with cooler water in the summer months and warmer water in the winter months. It also provides a pool of water to draw from when encountering adverse intake conditions, resulting in temporary loss of water flows. The water right for this source is 16 cfs. Well water is pumped from two separate sources to an aeration tower, and

then gravity fed to the rearing units and the domestic pump building. The combined well water right is 2 cfs, with well #2 running around 54 – 57 degrees F and well #3 running a constant 61 degrees F. Spring water is pumped from an underground collection site to the same aeration tower and gravity fed to rearing units. The water right for this source is 5.3 cfs, and has a stable temperature of 51-52 degrees F.

- The Team was unable to determine if the Service is the owner of record for the water right(s) for Tucannon FH and Curl Lake Acclimation Pond.
- The Team was unable to determine if water diversions are adequately measured and reported to meet Service standards for documenting beneficial use and state standards for annual reporting
- The sluice way to the Rainbow Lake intake is being undermined and requires repair.
- The Rainbow Lake intake screen meets NOAA screening criteria.
- The Rainbow Lake outlet channel is an earthen dam structure that is monitored frequently by WDFW hatchery and wildlife staff.
- The rotating drum screen at the outlet of Rainbow Lake requires maintenance. The outlet screen is aged and a request has been put in for replacement in 2009.
- The Hatchery staff reported no water quantity issues at Tucannon FH.
- Rainbow Lake is stocked with rainbow trout and managed for public fishing.
- The volume of Rainbow Lake has been reduced by ½ due to silt buildup..
- WDFW is investigating alternatives for improving the rearing environment at Tucannon FH. However, modifications to the facility to use natural rearing techniques may be cost limited.
- The facility has a low and high water alarm system and an emergency backup generator that provides power to the entire facility.
- There are no shade covers over any of the ponds.
- There is overhead wire but no bird netting over the circular ponds. WDFW has put in a request for netting over these ponds (2009).
- There is no predation control (fencing or netting/wire) around the two small raceways. The earthen pond is protected with a low 4’ chain link and electric fence to reduce otter predation. Overhead wire is used to reduce bird predation. The single large raceway is surrounded by a 6’ chain link fence but has no bird predation control.

<u>Curl Lake Acclimation Pond</u>

- Curl Lake AP has a water right of 2,694 gpm (6 cfs), though rarely more than 5 cfs is used. . It is supplied with water from the Tucannon River through a gravity water supply system. It is currently utilized for acclimation of spring Chinook yearlings for release into the Tucannon River.

Water temperatures at this time of year range from 34 to 48 o F. Based on the river water temperature, oxygen levels range between 11-14 ppm.

- Curl Lake Acclimation Pond is a 0.85 hectare natural bottom lake, with a mean depth of 2.7 m (pond volume estimated at 22,203.3 m3), and is supplied with a maximum of 0.17 cms (m3/sec) (6 cfs or ~2,690 gal/min) river water.

- Curl Lake water is held in by an earthen dam that is monitored frequently by WDFW hatchery and wildlife staff.

Research, Education, and Outreach

- The spring Chinook are 100% coded-wire and elastomer tagged with no adipose-fin clip. The elastomer tags are used for a size at release study that is ongoing. The elastomer tags are used to identify the different fish size groups when sampled, prior to release and during migration. Spring Chinook are split into two groups when marked. At Tucannon FH, the two groups are fed at different rates and put on different water temperatures. The size at release goals for each group are 9 and 15 fish per pound. Results are forthcoming.

- 2,500 PIT tags are also applied to each release group as part of the size at release study. PIT tags are used to study the emigration timing and relative success of the hatchery releases.

- Coded-wire tag data provides information regarding contribution to fisheries. PIT tag data provides juvenile survival information through the Columbia River basin dams.

- A smolt trap is operated on the Tucannon River to monitor hatchery and natural-origin spring Chinook outmigration.

- Redd surveys and smolt trap operations are used to monitor natural-origin spring Chinook abundance and productivity.

- For broodyears 1997-2002, a captive brood study was performed. The program was only planned for one generation to reduce the genetic impacts. Additionally, smolt-to-adult survivals for the conventional supplementation program have been better than the captive brood program. The captive brood adults were held in circular tanks at Lyons Ferry FH. The program may be reinstated as a "safety net" program, as identified in the Federal Columbia River Power System Biological Opinion, so that production goals can be met on an annual basis.

- Captive brood progeny were released from 2002-2007. In 2007, estimated survival of PIT tagged releases from Curl Lake to Lower Monumental Dam was estimated at 0.68 for supplementation releases and 0.61 for captive releases. . Additional information on smolt to adult survival rates is forthcoming and will continue until 2011, when the last adult should return from the captive program.

- An initiative is being developed among LSRCP comanagers to standardize monitoring and evaluation and create a standardized data management system for data entry and reporting.

- Approximately, 1,200 tourists visit Tucannon FH annually.

- Occasional school and college tours occur at Tucannon FH, especially during broodstock collection and spawning. Tourists traveling to the wildlife area and summer anglers stop in to tour the facility.

- Fishing opportunities are provided to the public at Rainbow Lake on the Tucannon FH property (estimated 10,000 fish harvested; 15,000 angler hours). Curl Lake is also stocked with rainbow trout to provide fishing opportunity over the summer. The US Forest Service holds an annual fishing derby on Rainbow Lake.

- Tucannon FH maintains a Kids Fishing pond in Dayton.

- Tucannon FH has a visitors' kiosk with signs describing salmon life-history, the Snake and Columbia River basin environment, and hatchery production.

- The USFWS maintains a web site with the goal to provide timely information to the public regarding hatchery operations and program benefits.

- WDFW does not have a web page describing Tucannon FH and its programs.

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[54] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- There is very little tribal, or sport harvest benefit inside the project area (Snake River and Tucannon River). Currently, Tucannon River spring Chinook are not adipose-fin clipped and are not available for mark-selective fisheries.

- The long-term goal of the program is to rebuild the Tucannon spring Chinook population to a sustainable level which can provide recreational and tribal fishing opportunities.

Conservation Benefits

- Currently, the program operates to increase the number of naturally reproducing Tucannon River spring Chinook. This is accomplished by allowing Tucannon River endemic stock returning hatchery adults to spawn in primary spring Chinook spawning/rearing areas in the Tucannon basin.

- The hatchery broodstock serves as a genetic reserve for the Tucannon spring Chinook population.

- The spring Chinook captive broodstock program developed methodology and is monitoring results which can be useful in determining future need/role of captive programs for rebuilding numbers of Tucannon spring Chinook.

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[54] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*

- The program reduces the demographic extinction risk of Tucannon spring Chinook because the recruits-per-spawner for the naturally spawning population is approximately 0.5, but greater than 1.0 for fish spawned in the hatchery.

Research, Education, Outreach and Cultural Benefits

- The experimental captive broodstock program for Tucannon spring Chinook contributed valuable research information regarding the use of captive broodstock strategies in rebuilding this threatened salmon stock.

- Spring Chinook are historically an important subsistence food source for Native peoples in the region. Restoring a harvestable population will maintain an important cultural opportunity.

- Tucannon FH is located adjacent to the Wooten Wildlife Area and Camp Wooten and provides educational opportunities to anglers and tourists that come to the area.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[55] the Review Team identified the following benefits of this program:

Harvest Benefits

- There is very little commercial, tribal or recreational harvest benefit downstream of the project area. Tucannon River spring Chinook are not adipose-fin clipped and are not available for mark-selective fisheries.

- Based on 1985-2003 brood year coded-wire tag recoveries reported to the RMIS database, sport and commercial harvest combined accounted for an average of less than 2% of the adult Tucannon River hatchery fish recovered for the 1985-1996 brood years, but increased fishery impacts occurred for the 1997 through 1999 broods (fishery harvest comprised an average of 20% for recoveries). The subsequent cessation of adipose clipping of hatchery production, and additional fishery restrictions, resulted in a less than 1% fishery impact on the 2000-2003 Tucannon Spring Chinook broods. Estimated total harvest (based on data downloaded from RMIS database on 5/9/08) of Tucannon River hatchery Chinook harvested in fisheries reported by agencies other than WDFW (sport, treaty, and commercial fisheries) averaged 15.3 fish per broodyear (range 0-191) for broodyears 1985-2003. Estimated total harvest (based on data downloaded from RMIS database on 5/9/08) of Tucannon River hatchery Chinook harvested in fisheries reported by WDFW (sport, treaty, and commercial fisheries) averaged 1.4 fish per broodyear (range 0-14) for broodyears 1985-2003.

Conservation Benefits

- Tucannon spring Chinook is a possible donor stock for reintroduction of naturally spawning Chinook into Asotin Creek.

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[55] *Ibid.*

Research, Education, Outreach and Cultural Benefits

- The experimental captive broodstock program for Tucannon spring Chinook contributed valuable research information regarding the use of captive broodstock strategies in rebuilding threatened salmon stocks.

- Tucannon FH is located adjacent to the Wooten Wildlife Area and Camp Wooten and provides educational opportunities to anglers and tourists that come to the area.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[56] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- The comparatively low recruit to spawner ratio for naturally spawning fish coupled with the high proportion of hatchery-origin spring Chinook spawning in the Tucannon River inhibits development of a properly integrated program, which poses a genetic domestication risk to the Tucannon River spring Chinook population, although PNI is slightly greater than 0.5

- Removal of a substantial proportion of naturally produced Tucannon spring Chinook at the hatchery weir for the integrated broodstock program reduces the size of the naturally spawning population reproducing in the natural habitat posing genetic and demographic risks to the natural population.

Demographic Risks

- Lack of shade covers over the raceways concentrates fish in shaded areas along raceway walls during summer months, increasing densities and potential stress, which can exacerbate fish health risks.

- Predation control (fencing, bird netting, etc) is limited at Tucannon FH, posing a risk of loss due to predation.

- Transportation of adults to the holding and spawning site (Lyons Ferry FH) and juveniles to the intermediate rearing site (Tucannon FH) and to the acclimation site (Curl Lake) poses demographics risk to the stock during transport and physiological (stress) risks during loading, transport, and following release.

- The four Columbia River and two Snake River dams significantly reduce the survival of outmigrating juveniles and returning adults, posing a demographic risk to the return of sufficient numbers of adults for harvest on a consistent basis.

- A power outage at Lyons Ferry FH poses a risk of catastrophic loss to the Tucannon spring Chinook stock.

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[56] *Ibid.*

- Sediment accumulation has reduced the water storage capacity of Rainbow Lake, posing a risk of catastrophic loss when the intake is obstructed by debris during high flows.

Ecological Risks

- Silt accumulation in Rainbow Lake is a potential harbinger for disease, including IHNV, parasite hosts and bacteria, posing a fish health risk to the fish reared on station at Tucannon FH.

- Stocking of hatchery trout in the Tucannon FH water supply (Rainbow Lake) poses a disease risk to the program while juveniles are reared at Tucannon FH

- Anadromous fish in the Tucannon FH and Curl Lake water supply (Tucannon River) pose a disease transmission to the propagated stock.

- Amplification of disease within the hatchery poses a disease risk to the propagated stock.

- Unidentified environmental limitations, potentially including warm water temperatures in the lower Tucannon River, lack of pools and riparian habitat, may be preventing adult spring Chinook from returning and accessing primary spawning habitat.

- Unidentified environmental limitations, including temperature, sedimentation, parasites (e.g. *Nucleospora salmonis, Ceratomyxa shasta*) or potential predators, may reduce egg-to-smolt survival in the Tucannon River.

- Ecological risk from antibiotic resistance in bacterial flora within the system from erythromycin injections and prophylactic use of medicated feeds for hatchery-reared fish, and antibiotics in effluent.

Physical Risks

See the Lyons Ferry fall Chinook section for physical risks associated with Lyons Ferry FH.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[57] the Review Team identified the following risks from the hatchery program:

[57] *Ibid.*

Genetic Risks

- Returning hatchery adults produced by the Tucannon spring Chinook program that do not home to the Tucannon River may pose a genetic risk to other naturally spawning spring Chinook populations.

Demographic Risks

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in raceways that are over loaded and poses a potential risk to other hatchery populations.

- Operation of weirs and traps for spring Chinook and steelhead hatchery programs in the Tucannon River pose risks of migration blockage, injury, and stress to other endemic fish species within the Tucannon Basin.

Ecological Risks

- The release of untreated effluent from the spawning area poses fish health and potential water quality risks to fish and other species downstream of Lyons Ferry FH.

- Returning adults produced by the Tucannon spring Chinook program that do not home to the Tucannon River and reproduce elsewhere may pose a competitive ecological risk to other natural spring Chinook populations.

- The collection and barging of spring Chinook smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program[58]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

[58] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

Issue TR-SC1: Program goals, separate from mitigation goals and escapement goals for natural-origin adults, are not prioritized or expressed in terms of numeric outcomes that quantify intended benefits. *According to the HGMP (2005), the purpose of the program is to "provide mitigation under the LSRCP program [by returning 1,152 hatchery-origin spring Chinook back to the Tucannon River] while meeting conservation and recovery criteria established for the Tucannon River population and the Snake River spring/summer Chinook ESU." Additionally, the HGMP states that, "the goal of the program is the restoration and enhancement of spring Chinook salmon in the Tucannon River using supplementation with the indigenous stock. The HGMP also lists a preservation/conservation goal of conserving the genetic resources of the naturally reproducing Tucannon River spring Chinook population. These are both short-term and long-term goals that are not prioritized and under current conditions with the existing hatchery program, appear to be confounded and not jointly attainable. Methods and goals are also confounded because "supplementation" is a "method", not a "goal". In this context, other "methods" may have a higher likelihood of achieving the desired or presumed "goal" of the program.*

Recommendation TR-SC1: Restate and prioritize program goals in terms of long-term numeric outcomes for the following parameters: (a) natural population abundance and viability (conservation goals); (b) the total number of hatchery-origin fish returning to the Tucannon River (mitigation goal), and (c) the proportions and desired numbers of the preceding two groups of fish allocated for broodstock, natural-spawning escapement, and harvest. Both short-term and long-term goals need to be clearly articulated before objectives and methods are developed. Short-term goals should be established that are attainable under current conditions. Benchmarks should also be established for measuring success or failure of the program in meeting goals and to provide guidance for future program actions. Based upon the information available about the program and the current condition of the naturally spawning population of spring Chinook in the Tucannon River (with a geometric mean recruit-to-spawner ratio of R/S≈0.6), the Team has assumed that the immediate short-term goal of the program is to prevent extinction of the Tucannon River spring Chinook stock. If this assumption is correct, then the size of the hatchery program should be adjusted to specifically address that goal (see below).

Broodstock Choice and Collection

Issue TR-SC2: An insufficient number of hatchery and natural-origin adults return to the Tucannon River to meet the current broodstock collection goal of 170 spring Chinook, composed of 50% natural-origin and 50% hatchery-origin fish. *Establishing a broodstock collection goal of 170 fish as a priority may result in "broodstock mining" of natural-origin fish and impede achievement of short-term conservation goals for the natural population. Broodstock collection goals need to be adjusted and prioritized to avoid conflicts between conservation goals for the naturally spawning population and mitigation-harvest goals of the program (see Issue TR-SC1). Three alternative recommendations are presented below, only one of which can be implemented, depending on comanager goals and priorities for spring Chinook in the Tucannon River.*

Recommendation TR-SC2a If the principle short-term goal of the program is to prevent extinction and maintain a viable natural population in the Tucannon River, then the Team recommends that comanagers reduce the size of the program to approximately 100,000 smolts consistent with HSRG recommendations for a "primary" population. Under this strategy, the relative numbers of hatchery and natural-origin adults retained for broodstock would need to

follow a sliding scale where the proportion of the broodstock composed of natural-origin fish (*pNOB*) would be reduced when the total number of natural-origin recruits available for broodstock was restricted by low numbers of returning adults. This adjusted "conservation" program would need to be consistent with HSRG guidelines for integrated hatchery populations of *primary* conservation value (i.e., *pHOS* <30% and *PNI* > 0.67). These guidelines can be achieved if mean *pHOS* is less than 25% and mean *pNOB* = 50% over continuously-running, four-year cycles (one salmon generation). To meet these guidelines, the deliberate passage of hatchery-origin spring Chinook upstream of the weir will need to be reduced (see Issue and Recommendation TR-SC3 below). Potentially reducing the proportion of the broodstock composed of natural-origin fish to less than 50% (e.g., pNOB = 25%) while maintaining PNI > 0.50 (e.g., by not passing any hatchery-origin fish upstream of the weir for several years) may be desirable while the naturally spawning population upstream of the weir stabilizes assuming that sufficient numbers of natural-origin recruits are available to meet minimum natural-spawning escapement goals under a conservation strategy. These recommended actions would need to be closely monitored, consistent with ongoing efforts.

Recommendation TR-SC2b: If the principle short-term goal of the program is to maximize the total number of adult recruits (hatchery + natural-origin) to the Tucannon River each year while – at the same time - maintaining a naturally spawning population in the Tucannon River where conservation is still a goal but not necessarily the first priority, then the Team recommends that comanagers adjust the size of the program to 160,000 smolts consistent with HSRG recommendations for a "contributing" population. Under this latter strategy, the relative numbers of hatchery and natural origin fish used for broodstock and passed upstream to spawn naturally would both be equal (i.e., mean *pNOB* = mean *pHOS* = 50%). A sliding scale could be implemented where *pNOB* is greater than 50% in "high" return years but less than 50% in "low" return years for natural-origin recruits. Under this latter strategy, the number of hatchery fish passed upstream of the weir would never exceed the number natural-origin fish passed upstream unless the naturally spawning population is at high short-term risk of extinction.

Recommendation TR-SC2c: If the principle short-term goal of the program is to simply maximize the total number of adult recruits back to the Tucannon River with the LSRCP mitigation goal representing the first priority and conservation of the naturally spawning population representing a lower priority, then all hatchery and natural-origin adults necessary for achieving the mitigation goal should be retained for broodstock (n = 85 male:female pairs) and all remaining fish passed upstream to spawn naturally. Under this management option, no restrictions would be placed on pNOB or pHOS, and the relative proportions of hatchery and natural origin fish retained for broodstock and passed upstream would be approximately identical and equal to their relative proportions among the fish trapped at the weir. This management strategy could result in no fish passed upstream of the weir in some years if the total number of trapped fish was less than the broodstock collection goal.

Hatchery and Natural Spawning, Adult Returns

Issue TR-SC3:.The composite natural spawning of hatchery- and natural-origin spring Chinook in the Tucannon River has a geometric mean recruit-to-spawner that is less than one (R/S<1.0). *The relatively large number of hatchery-origin spring Chinook spawning naturally in the Tucannon River (mean pHOS ≈ 47%) exceeds the HSRG guideline of pHOS < 30% for integrated hatchery programs. Moreover, the relatively large proportion of natural spawners composed of hatchery-origin fish is, most likely, (a) contributing to a mean R/S < 1.0 and (b)*

reducing R/S for natural-origin fish. The past management practice of allowing all hatchery-origin fish not retained for broodstock to spawn naturally upstream of the weir is a strategy that is not consistent with achieving a management goal of maintaing a viable natural population in the Tucannon River (see recommendation TR-SC2a). In addition, approximately 1/3 of all natural spawning of spring Chinook in the Tucannon River occurs downstream of the hatchery weir. Three alternative recommendations are presented below, only one of which can be implemented, depending on comanager goals and priorities for spring Chinook in the Tucannon River.

Recommendation TR-SC3a: If the principle short-term goal of the program is to prevent extinction and maintain a viable natural population in the Tucannon River, then discontinue passing hatchery-origin spring Chinook upstream of the hatchery weir and manage that portion of the naturally spawning population as a natural population reserve. Monitor and evaluate recruit-to-spawner ratios for the natural population for at least one full generation (5-6 years) to determine whether the value of R/S increases with a different management strategy. A second generation of not passing hatchery-origin fish upstream should be investigated to determine whether the population upstream of the weir can achieve a level of self-sustainability with R/S > 1.0. Investigate the feasibility of constructing a permanent weir in the lower Tucannon River, downstream from all natural spawning areas, to provide greater management control of the naturally-spawning population. Such a weir would also facilitate management of steelhead in the Tucannon River (see Tucannon River steelhead Issue and Recommendation TR-SS11). The Review Team concluded that the demographic risks of drastically reducing the "supplementation" component of the program upstream of the weir were minor - compared to the potential genetic and demographic benefits of such actions - because that supplementation component could be reinstated at any time if such actions were necessary to prevent extinction of a naturally spawning population of spring Chinook in the upper Tucannon River. At the present time, the population dynamics of spring Chinook in the Tucannon River are dominated by hatchery-origin fish, thus masking the natural reproductive capabilities of the natural population. Surplus hatchery-origin fish trapped at the weir but not retained for broodstock can be provided to the tribes for subsistence or to food banks. A fishery on hatchery-origin spring Chinook downstream from the weir may also be possible in high return years.

Recommendation TR-SC3b: If the principle short-term goal of the program is to maximize the total number of adult recruits (hatchery + natural-origin) to the Tucannon River each year while – at the same time - maintaining a naturally spawning population in the Tucannon River where conservation is still a goal but not necessarily the first priority, then the relative numbers of hatchery and natural origin fish passed upstream to spawn naturally would both be equal (i.e., mean pNOB = mean pHOS = 50%). Under this strategy, the number of hatchery fish passed upstream of the weir would never exceed the number natural-origin fish passed upstream unless the naturally spawning population is at high short-term risk of extinction.

Recommendation TR-SC3c: If the principle short-term goal of the program is to simply maximize the total number of adult recruits back to the Tucannon River with the LSRCP mitigation goal representing the first priority and conservation of the naturally spawning population representing a lower priority, then all hatchery and natural-origin adults necessary for achieving the mitigation goal should be retained for broodstock (n = 85 male:female pairs) and all remaining fish passed upstream to spawn naturally. Under this management option, no restrictions would be placed on pNOB or pHOS, and the relative proportions of hatchery and natural origin fish passed upstream would be approximately identical and equal to their

relative proportions among the fish trapped at the weir. This management strategy could result in no fish passed upstream of the weir in some years if the total number of trapped fish was less than the broodstock collection goal.

Incubation and Rearing

Issue TR-SC4: Juvenile spring Chinook are given a medicated feed to help control bacterial kidney disease. *These treatments are given prophylactically (i.e. when the fish do not show clinical signs of disease). The U.S. Department of Agriculture and other federal agencies have published warnings and advisories regarding the biological risks and potential overuse of antibiotics.*

Recommendation TR-SC4: Re-evaluate the need for regularly scheduled prophylactic use of erythromycin feed with the goal of phasing out its use. Included in this phase-out could be a study that evaluates adult returns from erythromycin treated and untreated (control) juvenile groups.

Release and Outmigration

Issue TR-SC5: Currently, no fish-health examination of juvenile spring Chinook occurs before those fish are transferred from Tucannon FH to Curl Lake and/or released from Curl Lake into the Tucannon River. The spring Chinook juveniles are held on river water that contains migrating adult salmonids, a potential source of pathogen transmission to hatchery juveniles. *Pre-release exams which include testing for virus, bacteria and parasites are not done. There is a risk that endemic or exotic pathogens with no clinical signs of infection among juveniles prior to release into the Tucannon River can go undetected with potential transmission to other aquatic animals. Expanded sampling for pathogens prior to release may also provide increased insight into Tucannon spring Chinook survival. Pre-release exams, conducted 4-6 weeks before release or transfer, are required by USFWS fish health policy FW 713 and the Integrated Hatchery Operations Team (IHOT).*

Recommendation TR-SC5: Sample 60 fish of each brood for pre-release inspections to meet the American Fisheries Society – Fish Health Section Blue Book requirements to ensure a 95% confidence in detecting pathogens at the minimum assumed pathogen prevalence level of 5%. Along with viral testing, juvenile spring Chinook should also be tested for bacteria and parasites which may be endemic to the Tucannon River. Potential, undetected infections with pathogens could be a factor in post-release survival and return rates.

Facilities/Operations

Lyons Ferry FH

See the Lyons Ferry FH Steelhead and Fall Chinook sections for facility issues and recommendations.

Tucannon FH

See Issue/recommendation TR-SS11 in the Tucannon River steelhead section regarding establishing a permanent weir at the location of the temporary weir.

Issue TR-SC6: Lack of shade covers over the raceway increases crowding of fish, particularly during the summer months, potentially increasing stress and disease risks to spring Chinook juveniles and other fish reared on station. *However, Tucannon FH receives limited sunlight due to its location and the spring Chinook are not reared at Tucannon FH during the summer.*

Recommendation TR-SC6: Construct shade covers over the raceways.

Issue TR-SC7: Although on-station predation is considered minimal, the facility lacks predator exclusion mechanisms such as bird netting and fencing around some of the ponds and raceways.

Recommendation TR-SC8: Construct complete predator exclusion mechanisms around all rearing units (i.e. fencing and bird netting).

Issue TR-SC8: The intake diversion (sluice way) is being undermined and requires repair. Intake failure could result in a catastrophic loss to fish reared on station.

Recommendation TR-SC8: Consult with the Service's Region 1 Engineering Division to repair the sluice way.

Issue TR-SC9: Rainbow Lake is used as a water source for Tucannon FH and is also stocked with catchable trout which may pose a fish health risk to fish in hatchery.

Recommendation TR-SC9a: In the near term, discontinue stocking Rainbow Lake with catchable trout.

Recommendation TR-SC9b: Enclose the water supply to Tucannon FH from the Tucannon River from the river diversion to the existing intake pipe below Rainbow Lake. Reconfigure Rainbow Lake intake so it continues to fill with Tucannon River water so recreational fishery may continue. Configure plumbing to the hatchery so that, in an emergency, Rainbow Lake could be used for backup water.

Issue TR-SC10: Rainbow Lake is part of the water supply for Tucannon FH[59]; however, its capacity has been reduced due to the accumulation of silt. *Silt accumulation in Rainbow Lake is also a potential harbinger for disease, including IHNV, parasite hosts and bacteria, posing a fish health risk to the fish reared on station at Tucannon FH*

Recommendation TR-SC10: Dredge the accumulated silt from Rainbow Lake.

Issue TR-SC11: The Lower Snake River Compensation Plan office is reviewing the ownership status of water rights associated with all comanager-operated facilities which divert water for fish culture. *Although ownership of several of the facilities has been transferred to the Service, the appropriate documentation to transfer the water rights may not have been filed in the respective state agency which administers water rights. Moreover, facility staff may not consistently or adequately record water use to ensure documentation of beneficial use in*

[59] *Tucannon River water travels into the lake and from the lake into the hatchery.*

support of its water right(s) and as required by state law . Adequate documentation and reporting are required to maintain the right to divert water.

Recommendation TR-SC11: Work with the Lower Snake River Compensation Plan office to ensure water diverted to the Tucannon FH and Curl Lake Acclimation Pond for fish culture is measured and reported correctly. Water use information needs to be maintained by the Service's Region 1 Engineering, Water Resources Branch.

Research, Monitoring, and Accountability

Also see issue and recommendation LF-FC24, 25, and 26 in the Lyons Ferry Fall Chinook section above.

Issue TR-SC12a: Smolt productivity for natural-origin spring Chinook is poor in the Tucannon River which limits adult returns. *Multiple issues may be contributing to poor survival, including disease, predation by introduced species (e.g., brown trout), and habitat constraints. Predation and habitat limitations may profoundly impact survival; however, control of these issues is limited. WDFW is currently performing a size at release study. Findings of this study may prove beneficial for increasing survival in association with predation and habitat limitations. Regarding disease constraints: Endemic parasites can significantly limit juvenile survival, especially if the stock has not developed an innate resistance. Natural-origin spring Chinook may have some innate resistance to endemic parasites, particularly myxosporideans. However, the rearing of this stock on well water at Lyons Ferry FH and/or Tucannon FH would not select for fish with an inherited resistance for parasites endemic to Tucannon River. The Tucannon FH juveniles, in particular those exposed to river water, may present an opportunity to assess endemic parasites that could be limiting the natural production of spring Chinook. The parasite Nucleospora salmonis has been detected in a limited sampling of the spring Chinook juveniles at the Tucannon FH. This parasite debilitates the immune system of salmonids and is implicated in losses of juveniles in other Snake River programs. Currently, sampling for myxosporidean parasites is limited to M. cerebralis monitoring in the rainbow trout once every three years.*

Issue TR-SC12b: If Tucannon River stocks carry an endemic parasite, stray fish could serve as vectors of the parasite to other basins.

Recommendation TR-SC12: Continue to investigate the causes of poor smolt productivity. Test for parasites, including *N. salmonis* , *C. shasta* and other myxosporideans, in Tucannon FH juveniles (rainbow trout and acclimated steelhead, spring Chinook) and adults returning to the Tucannon River. Consider rearing spring Chinook from egg through smolt stage exclusively on Tucannon River water as a means to test for endemic parasites that may be infecting Tucannon River natural-origin fish. Alternatively, a net pen of Chinook salmon fry in Curl or Rainbow Lakes could serve as sentinel fish for monitoring of parasites. If fish parasites are found in the Tucannon River, consider managing spring Chinook in the Tucannon River to enhance innate resistance to endemic parasites. This could include collecting natural-origin adults and rearing their progeny at Tucannon FH on river water with some potential to significant mortality during the development of resistant offspring.

Issue TR-SC13: Spring Chinook have been observed at the Lyon Ferry hatchery trap outfall. *To date, the trap at Lyons Ferry FH has not been operated to collect spring Chinook; therefore, the origin of these fish has not been determined.*

Recommendation TR-SC13: Spring Chinook observed at the Lyons Ferry FH outfall should be collected to determine their origin. Spring Chinook identified as Tucannon spring Chinook could be used as last-resort "backfills" to make-up for broodstock shortages resulting from the trapping of spring Chinook in the Tucannon River. However, the collection of broodstock anywhere other than the Tucannon River should be considered a "last resort" and generally discouraged.

Issue TR-SC14: Recruit per spawner(R/S) for naturally spawning Tucannon spring Chinook is less than one (R/S<1.0), and a significant number of hatchery fish are spawning each year. *The reproductive success of hatchery and natural fish passed upstream and spawning naturally are unknown.*

Recommendation TR-SC14: Conduct a pedigree analysis to determine and compare the reproductive success of hatchery and natural-origin Tucannon spring Chinook passed upstream of the weir. If possible, use archived scale (or tissue) samples to conduct this study, particularly in view of Recommendation TR-SC2b. Results of this type of study would help in the decision in the proportion of hatchery and natural fish passed upstream to spawn naturally.

Issue TR-SC15a: Tucannon spring Chinook reportedly have a high degree of straying upstream of Lower Granite dam. *Approximately 57.1% of the returning PIT tagged hatchery-origin spring Chinook and 50.0% natural-origin PIT tagged spring Chinook were detected at Lower Granite Dam. This straying may be posing a demographic risk to the spring Chinook population in the Tucannon River (by reducing SARs back to the Tucannon River) for both hatchery and natural-origin fish and a genetic risk to naturally spawning populations upstream of Lower Granite Dam. Habitat limitations such as flooding of the lower Tucannon River by the pool behind Lower Monumental Dam may reduce attraction water and contribute to straying by both hatchery and natural-origin fish. The hatchery program does not appear to be the cause of straying because both hatchery and natural-origin spring Chinook from the Tucannon River stray upstream of Lower Granite Dam at approximately the same rate.*

Issue TR-SC15b: Preliminary stray information is based upon very few recoveries of PIT tagged fish*. The PIT tag level was 1,000 hatchery and 1,000 natural smolts. PIT tagging was increased in brood year 2005 to 5,000 total hatchery-origin fish as part of the size at release study.*

Recommendation TR-SC15*:* Continue to investigate the degree of homing and straying and the potential causes. Increase the PIT tagging level to approximately 10,000 -origin smolts. PIT-tag all natural-origin smolts captured during smolt trap operations (≈3,000 smolts per year).

Education and Outreach

See the Lyons Ferry Fall Chinook section for Education and Outreach issues and recommendations regarding Lyons Ferry FH.

Issue TR-SC16: The Tucannon FH displays and handouts are outdated. *The existing Tucannon FH displays were installed in the 1980's-early 90's when the facility was constructed.*

Recommendation TR-SC16: Update the displays and handouts so that they accurately reflect the current status of salmon and steelhead in the Snake River and the associated hatchery programs at Tucannon FH.

Issue TR-SC17: The information available to the public regarding the Tucannon FH and its associated programs is inadequate. *The LSRCP web site lacks information about the hatchery for the public. Additionally, WDFW does not currently manage a web page for Tucannon FH.*

Recommendation TR-SC17: Information regarding the harvest and conservation benefits of the programs at Tucannon FH should be made available by the Service and WDFW in a format for public consumption (e.g. simple brochures, interactive web pages, etc.). For example, fishery benefits provided by the program for each hatchery could be updated annually on the LSRCP web site and provided in a brochure at the hatchery. If the LSRCP web site is the primary source of information for the program, any WDFW page for Tucannon FH should be linked to this site.

Alternatives to Current Program

The Review Team considered the benefits and risks of the existing spring Chinook program at Lyons Ferry FH and developed seven alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

Alternative 1: Current program with recommendations

Continue to develop an integrated conservation program in the Tucannon River upstream of the weir whose size is based on the number of natural-origin returns to the weir. Assess the viability of the naturally spawning population by suspending the passage of hatchery-origin adults upstream of the weir. Investigate the feasibility of a permanent weir site in the lower Tucannon River below the primary spawning areas.

Pros

- Reduces pHOS to < 25% in the naturally spawning Tucannon River spring Chinook population .
- Reduces taking of Reduces the take of natural-origin spring Chinook for broodstock (pNOB <50%).
- Reduces genetic and ecological risks posed by hatchery-origin fish spawning naturally.
- Expected to increase the productivity (R/S) of the naturally spawning population above the weir.
- Prioritizes conservation goals for Tucannon River spring Chinook.

Cons

- May reduce the potential for providing harvestable Chinook some years.
- May increase the demographic risk of extirpation of the naturally spawning Tucannon River population upstream of the weir if R/S of the natural population remains below 1.0 over several years.
- Does not include all natural-origin spawners available for broodstock if a permanent weir is not constructed in the lower River (33% that spawn below the Tucannon River FH weir).
- Poses disease transmission risks between the Lyons Ferry FH and Tucannon FH and their associated river basins.
- The Tucannon spring Chinook's complete captive life cycle is not on the Tucannon River water source itself, reducing local adaptation for the propagated stock.

Alternative 2: Rear spring Chinook full-term at Tucannon FH

Rear Tucannon spring Chinook for their full captive life cycle at Tucannon FH. .

Pros

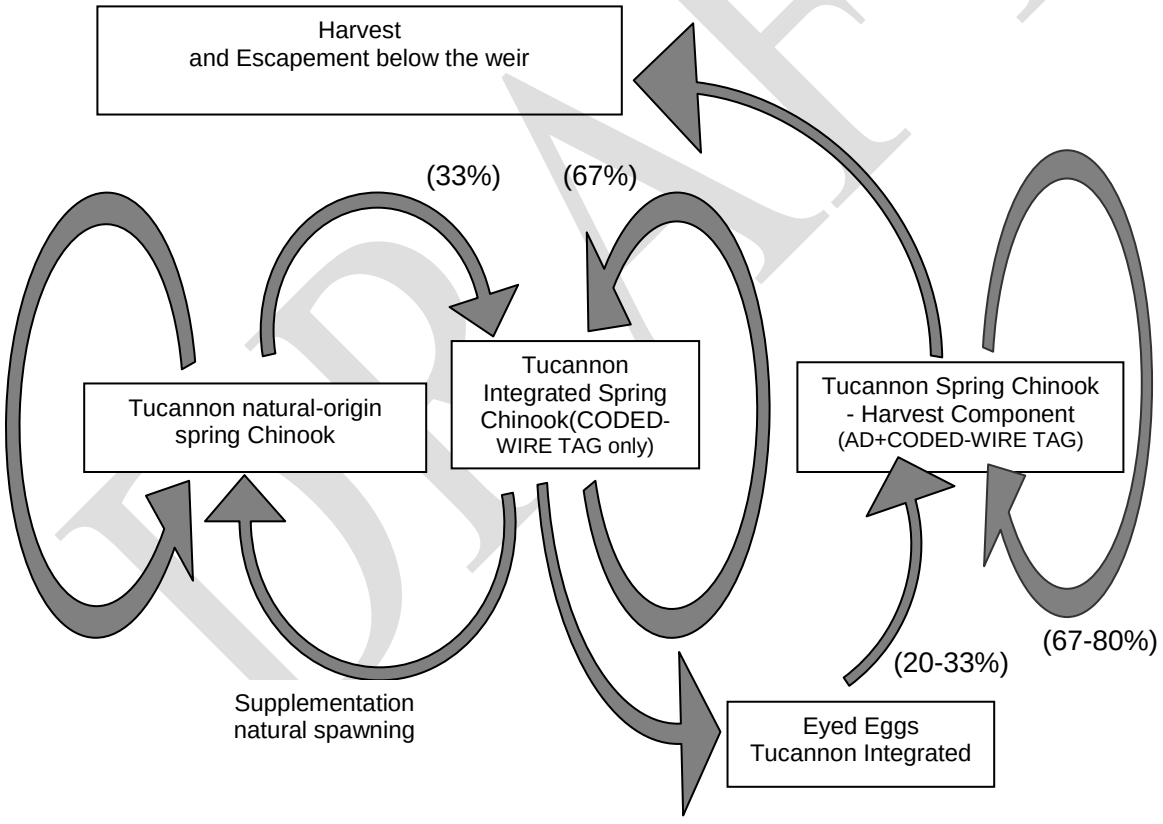
- Provides full-term rearing of Chinook on Tucannon River water.
- May reduce straying of returning adults.
- Frees up space at Lyons Ferry FH.
- Eliminates the need to transfer fish between facilities.
- Reduces the risk of disease transmission between Lyons Ferry FH and Tucannon FH, assuming Tucannon steelhead are still transferred between the facilities.
- Simplifies the program.
- Eliminates the potential for direct releases into the mainstem Snake River if there is a loss of water supply at Lyons Ferry FH.

Cons

- Requires significant investment in facility infrastructure at Tucannon FH (e.g. well water or chilling for adult holding and juvenile rearing, additional rearing space, marking and tagging facilities).
- May increase fish health risks if the Tucannon spring Chinook are reared on Tucannon River water for an extended portion of their captive life cycle since the water source contains anadromous fish.
- May not address straying issue if straying is hydrosystem or environmentally caused.

Alternative 3: Convert the current integrated program to a stepping-stone program utilizing the entire Tucannon River spring Chinook population, achieved by establishing a permanent weir downstream of the entire spawning area.

To work toward meeting the LSRCP mitigation goal of 1,152 adults back to the Tucannon River and to jointly work toward meeting the conservation goals for natural-origin Tucannon spring Chinook, convert the entire Tucannon spring Chinook program from an integrated to a stepping stone program by incorporating gametes from adults trapped at a new weir constructed downstream of the entire spawning area. This could be accomplished at Tucannon/Lyons Ferry FHs by differentially marking broodstock where the integrated conservation component would be coded-wire tag-only and the harvest component would be adipose-fin clip/coded-wire tag. The program size would be approximately 100,000 for the integrated component and approximately 150,000-200,000 for the harvest component. Continue to release integrated component spring Chinook from Curl Lake and consider acclimating and releasing the harvest component spring Chinook below the weir. The harvest component can be released from the Tucannon River and/or from Lyons Ferry FH.



Pros

- Reduces pHOS in the naturally spawning population.
- Reduces the take of natural-origin spring Chinook for broodstock.
- Increases the viability of the naturally spawning population.

- A weir in the lower Tucannon River would increase the number of natural-origin spawners available for the program (33% that spawn below the Tucannon River FH weir).

- May increase the potential for meeting harvest mitigation goals.

- If fish are released at Lyons Ferry FH, returns to Lyons Ferry FH act as a genetic repository for Tucannon Spring Chinook population.

Cons

- Requires a significant investment in infrastructure to construct a permanent weir in the lower Tucannon River.

- The current geometric mean recruits per spawner for the natural-origin population may prohibit a stepping stone program from operating successfully.

- May not reduce the demographic risk of extirpation of the naturally spawning Tucannon River population upstream of the weir if R/S of the natural population remains below 1.0 over several years.

- Poses disease transmission risks between the Lyons Ferry FH and Tucannon FH and their associated river basins.

- The Tucannon spring Chinook's complete captive life cycle is not on the Tucannon River water source itself, reducing local adaptation for the propagated stock.

Alternative 4: Manage the population upstream of the weir (existing or downstream location) for natural production only and establish a segregated program for harvest mitigation with releases in the Tucannon River, Lyons Ferry FH, and/or the Palouse arm.

To work toward meeting the LSRCP mitigation goal, establish a segregated program for harvest mitigation and manage the population upstream of the Tucannon weir for natural production only. The segregated program does not necessarily have be established in the Tucannon River, or utilize Tucannon River spring Chinook as the broodstock source of the program. For example spring Chinook could be released from Lyons Ferry FH or the Palouse arm.

Pros

- Reduces or eliminates pHOS in the natural population, especially if a permanent weir is constructed downstream or if the hatchery-origin spring Chinook are released from another location.

- Reduces genetic and ecological risks posed by hatchery-origin fish spawning naturally.

- Expected to increase the productivity (R/S) of the naturally spawning population above the weir.

- Eliminates taking a portion of the natural-origin population for broodstock.

- Potentially provides more fish available for harvest below the weir or outside the Tucannon River Basin.

- May increase the potential for meeting harvest mitigation goals.

Cons

- May require the use of an alternative broodstock if there are not enough Tucannon spring Chinook to establish a segregated program.

- May pose risks to local fish populations associated with the release of an out-of-basin stock if another broodstock is used or if an alternative release site is chosen (e.g. Lyons Ferry FH and Palouse arm).

- May require additional acclimation and recovery facilities.

- May significantly increase the demographic risk of extirpation of the naturally spawning Tucannon River population upstream of the weir if R/S of the natural population remains below 1.0 over several years.

- Poses disease transmission risks between the Lyons Ferry FH and Tucannon FH or other release locations and their associated river basins.

- The Tucannon spring Chinook's complete captive life cycle is not on the Tucannon River water source itself, reducing local adaptation for the propagated stock.

Alternative 5: Use Tucannon spring Chinook to reintroduce spring Chinook in Asotin Creek (can be combined with other alternatives)

Utilize surplus hatchery-origin spring Chinook returns to the Tucannon River as broodstock to rear juveniles for release into the Asotin River and/or for outplanting adults.

Pros

- Provides a close source of fish for reintroduction into Asotin Creek.

- Provides an outlet for surplus hatchery-origin adults removed at the Tucannon River weir.

- May speed the reestablishment of a naturally spawning Chinook population in Asotin Creek.

- If successful, increases the viability of the Lower Snake River spring/summer Chinook MPG.

Cons

- Requires additional rearing space and potential investments in facility infrastructure if juveniles are reared and released (e.g. the development of acclimation of acclimation facility on Asotin Creek).

- Requires the take of additional hatchery-origin fish from the Tucannon River for broodstock.

- Fewer hatchery-origin fish returning to the Tucannon River may be available to spawn naturally in years where natural-origin returns are extremely low, which may pose a demographic risk to the Tucannon River spring Chinook population in some years.

- Poses a genetic risk to any remnant naturally spawning spring Chinook in Asotin Creek.

- Poses a risk of disease transmission to any remnant naturally spawning spring Chinook or other fish populations in Asotin Creek (potential vectoring of pathogens).

Alternative 6: Terminate the program and decommission Tucannon FH

Decommission hatchery in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site.

Pros

- Eliminates pHOS in the natural spawning population in the Tucannon River.

- Eliminates mining of natural spawning population in the Tucannon River.

- Increases the viability of the natural spawning population in the Tucannon River.

Cons

- Eliminates the harvest mitigation program.

- Increases the demographic risk of extinction of the Tucannon River population if R/S of the natural population remains below 1.0.

- Displaces other programs (e.g. rainbow trout) located at Tucannon FH.

Recommended Alternatives

The Team recommends Alternative 3, to convert the current integrated program of spring Chinook for the Tucannon River to a stepping-stone program using the entire Tucannon River spring Chinook population, which would be achieved by establishing a permanent weir in the lower Tucannon River below the primary spawning habitat for the entire population. This recommendation is intended to be implemented consistent with all recommendations in Alternative 1. The intent of this alternative is to develop specific management goals and objectives for conservation of the spring Chinook population in the Tucannon River using the integrated conservation component of the program to meet those objectives while also developing a harvest component to provide for Tribal and recreational fisheries and obtain the LSRCP mitigation goal of 1,152 adults back to the Tucannon River.

Gametes from adults trapped at the new weir constructed in the lower Tucannon River would be used to develop the integrated conservation component of the program whose size would be based annually on the returning natural population. Current low returns of naturally produced spring Chinook to the Tucannon River have resulted in the "broodstock mining" of natural-origin fish and have impeded the achievement of short-term conservation goals for the natural population. Short-term broodstock collection goals and program size for the conservation component above the weir should be adjusted and prioritized to levels that are consistent with the availability of natural and hatchery-origin fish and

meet guidelines for integrated hatchery populations of primary conservation value (i.e., pHOS<30% and PNI>0.67). These guidelines could be achieved if pHOS is less than 25% and the current broodstock strategy of pNOB=50% is retained.

To meet these guidelines, in the short-term, the deliberate passage of hatchery-origin spring Chinook upstream of the weir should be suspended. In addition, the number and proportion of hatchery and natural-origin fish retained for broodstock each year should be based on a sliding scale that is a function of the numbers and relative abundances of hatchery and natural-origin fish intercepted at the weir. Potentially reducing the proportion of the broodstock composed of natural-origin fish to a value less than 50% (e.g., pNOB = 25%) while maintaining PNI > 0.50 (i.e., pHOS < 25%) may be desirable as an interim measure while the naturally spawning population upstream of the weir potentially develops and stabilizes after passage of hatchery-origin fish is terminated as a near-term management action. Fish produced from the integrated component would continue to be released from Curl Lake. These recommendations assume that the first priority of the program, as a short-term interim goal, is reducing demographic risks to the natural population. These recommended actions would need to be closely monitored, consistent with ongoing efforts.

The harvest component would be developed from gametes collected from the integrated component that are in excess to the conservation objectives and the returning hatchery-origin spring Chinook and sized to meet the harvest goals and objectives developed by the co-managers. Both components of the program could be accomplished at Tucannon/Lyons Ferry FHs by differentially marking broodstock where the integrated conservation component would be coded-wire tag-only and the harvest component would be adipose-fin clip/coded-wire tag. The harvest component could be released at the weir and should consider the development of acclimation facilities.

The Team's recommendation is intended to meet the near-term conservation goals of the Tucannon River spring Chinook population, while developing a harvest component to meet fishery objectives in the area. The Team's recommended alternative is also meant to be consistent with the intent of the current *US v. Oregon* agreement.

The Team also recognizes that the recommendation will require a significant investment to develop a weir and acclimation facilities in the lower Tucannon River and that the recommendation could be initiated at the existing weir at Tucannon FH until such facilities were developed.

The Team also considered that Tucannon River spring Chinook could be used as an appropriate stock for reintroduction into Asotin Creek as part of a long-term recovery/rebuilding strategy. Availability of Tucannon River stock for the reintroduction into Asotin Creek would be based on the management strategy chosen for the Tucannon River population. For example, if the Team's recommended alternative was chosen, then gametes collected from the integrated component in excess to the conservation objectives in the Tucannon River (harvest component) could be used to develop a reintroduction program in Asotin Creek. This action would, at least temporarily, reduce the potential for harvest option in the Tucannon River until the reintroduced Asotin Creek population was rebuilt to a level that would not require continued use of spring Chinook from the Tucannon River.

While the Team also considered alternatives 1) current program with recommendations, 2) rearing spring Chinook full-term at Tucannon FH, and 4) managing the population upstream of the weir (current location or new weir downstream) for natural production while developing a segregated program for harvest with releases in the lower Tucannon River, at Lyons Ferry FH, and other locations outside the Tucannon River, we did not recommend these alternatives as a preferred alternative for a wide variety of facility, biological, and logistical reasons. The Team also felt that our recommended

alternative would be consistent with any potential actions that may be taken in the future to address ICTRT recovery recommendations.

The Team did not recommend Alternative 6, given the long-term needs to continue to conserve Tucannon River spring Chinook and to meet the management intent of the states and tribes under the current *US v Oregon* agreement.

Lyons Ferry Hatchery Summer Steelhead

Operator: Washington Department of Fish and Wildlife

Summary of Current Program

Goals

- ***Harvest goal:*** Provide sport and tribal fishing opportunities for summer steelhead in the Snake River, its tributaries, including off-site mitigation in the Walla-Walla Basin and downstream in the Columbia River. There is currently no quantified "harvest" goal for this program separate from the LSRCP adult mitigation return goals. The intent of the program is "return" 630 adults to the project area around Lyons Ferry FH for harvest and broodstock collection, 875 adults to the Tucannon River for harvest, 750 adults to the Touchet River for harvest, and 900 adults to the Walla Walla River for harvest. In this case, harvest goals can be derived from return goals. These LSRCP mitigation goals were based on the assumption that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (presumed 1:1 catch ratio).

- ***Broodstock escapement goal:*** Collect 1,650 adult steelhead for broodstock and recovery of Lyons Ferry stock coded-wire tags (~150 fish/week over the time period 1 September and 15 November). Keep 400-450 for broodstock (approximately 200 females and 200 males) and return the remaining steelhead to the river to be recycled in the fishery. Spawn approximately 300 steelhead (106 females and 200 males).

- ***Conservation goal:*** The program currently has no specific conservation goal.

- ***Escapement goal for natural-origin adults:*** Interim minimum abundance thresholds developed by the ICTRT for natural-origin steelhead in the project areas are as follows.

Tucannon	A	Intermediate	1,000
Touchet	A	Intermediate	1,000
Walla Walla	A	Intermediate	1,000

The recovery goals for the Tucannon, Touchet and Walla Walla rivers equal the minimum abundance thresholds.

The interim restoration goals from the Snake River Salmon Recovery Plan are:

Tucannon	1,823 - 3,400
Touchet	1,563 - 2,205
Walla Walla	1,875 -3,395

(pers. comm. Glen Mendel, WDFW, 2009)

- ***Research, education, and outreach goals:*** Provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and the stewardship of Lyons Ferry FH and LSRCP programs. The Dayton Lab monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex.

Objectives

- Collect 1,650 adult steelhead for broodstock and recovery of Lyons Ferry stock coded-wire tags (~150 fish/week over the time period 1 September and 15 November).
- Retain 400-450 adult steelhead for broodstock (approximately 200 females and 200 males).
- Return adult steelhead with no detected CWTs' back to the river to be recycled in the fishery.
- Spawn 106 females and 200 males to produce approximately 500,000 green eggs with the goal of obtaining 460,000 eyed eggs.
- Release 60,000 yearling smolts on-station at Lyons Ferry FH, 100,000 yearling smolts in the Tucannon River, 85,000 yearling smolts in the Touchet River, and 100,000 yearling smolts in the Walla Walla River. Total release objective = 345,000 smolts.

Program Description

The Lyons Ferry hatchery stock steelhead program was originally derived in the early 1980's from a combination of Wells Hatchery and Wallowa Hatchery steelhead stocks released at Lyons Ferry FH, the Tucannon River, the Touchet River and the Walla Walla River. The Lyons Ferry FH stock is considered an "A" run steelhead, typical of most Columbia River stocks. Other steelhead stocks were also used in the past to fulfill production as needed (Wallowa, Pahsimeroi, Oxbow, and Ringold stocks). Hatchery origin adults (mainly Wells and to a lesser extent Wallow stocks) were later trapped on site at Lyons Ferry FH to build what WDFW currently labels the Lyons Ferry FH stock summer steelhead. A large number of returning hatchery origin adults are trapped each year at Lyons Ferry FH for broodstock (currently about 2,000 fish annually), most of which (1,000-1,200) are eventually returned to the Snake River to be harvested. Released fish are marked (top caudal fin clip) to document their presence in the fishery following release.

The hatchery currently produces 345,000 summer steelhead smolts for release into the Touchet, Tucannon, and Walla Walla rivers and at the Lyons Ferry FH facility as specified in the objectives section of this report. All juvenile steelhead are marked with adipose fin clips and a portion of each release group receives left ventral fin clips and coded wire tags. Steelhead harvest in the Snake River Basin is managed as a mark-selective fishery.

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- The Lyons Ferry FH steelhead stock was originally derived in the early 1980's from a combination of Wells Hatchery and Wallowa Hatchery steelhead stocks released at Lyons Ferry FH, the Tucannon River, the Touchet River, and the Walla Walla River.

- NOAA Fisheries excluded this stock from any existing ESUs.

- The program is managed as segregated. Lyons Ferry FH steelhead (from all release sites), that are identified by a mark (adipose-fin clip and left ventral clip or adipose-fin clip only), are used for broodstock. Based on coded-wire tag recoveries, it is assumed that these adipose-fin clip only fish are Lyons Ferry stock.

- Broodstock are collected from returns to the hatchery. Lyons Ferry stock fish that are trapped at Lyons Ferry FH come from not only the on-station release, but also include fish that were released into the Tucannon, Touchet, and Walla Walla rivers. Based upon coded-wire tag data, 40% of the returns are from the on-station release, 25% from Touchet, 25% from Walla Walla, and 10% from Tucannon.

- Lyons Ferry hatchery steelhead adults are trapped at the facility in the fall – September 1 through November 15. Before 2003, steelhead were collected from July through November; however, collection time was shortened to reduce the hatchery staff's work load. A study of the progeny of Lyon's Ferry steelhead returns, performed before broodstock collection was truncated, indicated that the progeny of steelhead collected September through November still contribute equally across the run's entire return time. No studies have been performed since broodstock collection was truncated.

- Steelhead are at times inadvertently collected in the fall Chinook ponds during collection. This occurs because fall Chinook are collected simultaneously.

Hatchery and Natural Spawning, Adult Returns

- According to the 2008-2009 Lyons Ferry steelhead program AOP, all fish not retained for broodstock for the endemic program at the lower trap site (rivermile 25) on the Tucannon River will be "passed upstream for natural spawning". This includes natural-origin, endemic Tucannon and Lyons Ferry stock steelhead. Lyons Ferry stock steelhead are removed at the Tucannon FH weir at river mile 36 and only endemic and natural-origin steelhead are passed above the weir to spawn upstream.

- The proportion of Lyons Ferry stock to the endemic stock is approximately 5% at the Tucannon FH trap. The proportion of Lyons Ferry stock that reach the temporary trap in the lower river is much higher.

- Results of a genetic analysis of southeast Washington summer steelhead populations indicate that Lyons Ferry and Tucannon steelhead stocks have high genetic similarities, reinforcing WDFW's interpretations that significant genetic introgression has occurred between Lyons Ferry hatchery stock and the Tucannon endemic stock . (*see Research, Education and Outreach section below for a complete description*).

- Straying of Lyons Ferry stock steelhead to lower Columbia tributaries is not currently considered an issue. Less than 1% of all coded-wire tag recoveries from Lyons Ferry stock steelhead were in the Deschutes River upstream of Sherars Falls (average of 16 expanded recovery of adults for brood years 1987-2000 as cited in WDFW 2005 HGMP). However, straying has been identified as an issue for the Wallowa steelhead program (see the Wallowa steelhead program section for more information).

- Lyons Ferry stock steelhead released into the Touchet River have been shown to stray into other Columbia and Snake River basin rivers. WDFW realizes that straying of Lyons Ferry FH stock adult steelhead from past Touchet River releases is likely environmentally related (i.e. low river flows and high water temperature which restrict returning passage in the lower Walla Walla River), and regardless of the stock used, straying into other basins may still occur**.**

- Lyons Ferry stock steelhead released into the Tucannon River have been identified passing Lower Granite Dam and remaining above the dam and potentially straying to other tributaries, although stray rate appears to be low (WDFW 2005 HGMP).

- Lyons Ferry stock released on-station at Lyons Ferry FH have been identified passing Lower Granite Dam and remaining above the dam. The steelhead may be overwintering above the dam and potentially straying to other tributaries, although stray rate appears to be low (WDFW 2005 HGMP).

- Starting in 2008, Lyons Ferry stock juvenile steelhead have been PIT tagged (1,500 on-station release and 3,500 each for releases in the Touchet, Walla Walla, and Tucannon Rivers) which will help evaluate the number of adult hatchery fish returning past dams, to hatcheries and streams (Lyons Ferry FH Complex Annual Operations Plan 2008-2009).

- Spawning ground surveys occur in the Tucannon and Touchet rivers; however, often turbid water conditions limit the information obtained.

- Based on a combination of spawning ground surveys and weir counts, the estimated annual spawning escapement for the Touchet River is approximately 400-500 adult steelhead, with 5-20% being hatchery origin (half of the hatchery-origin are endemic Touchet hatchery stock and half Lyons Ferry FH stock). The estimated annual spawning escapement for the Tucannon River is 600-700 adult steelhead, with 50% endemic Tucannon FH and 10-20% Lyons Ferry FH stock.

- The estimated annual spawning escapement for Walla Walla steelhead, upstream of Nursery Bridge averaged 389 natural (range 224-722) and 14 hatchery origin (range 2-29) for the years 1992-93 to 2000-01 (Table 4-6 of 2004 subbasin plan). Video counts in 2001-02 and 2002-03 were 1,205 and 547 total steelhead, respectively. Video did not distinguish natural from hatchery, but based on previous counts at Nursery Bridge, the number of Lyons Ferry stock fish spawning in this area appears to be small.

- Weirs at Tucannon FH on the Tucannon River and at Dayton Pond on the Touchet River are used to control upstream passage of Lyons Ferry stock hatchery steelhead. The goal is to only pass natural-origin and endemic program-origin steelhead above the weirs; however, stream conditions (high flows) sometimes allow for uncontrolled passage above the weirs. The Touchet River weir is more often is not capable of controlling upstream passage compared to the Tucannon River weir. Recent modifications to the weirs (the addition of passage restriction panels) may improve control of fish passage.

- Lyons Ferry stock steelhead intercepted at the weirs on the Tucannon and Touchet rivers are recycled downstream in the fishery. Natural spawning of hatchery steelhead can occur in these areas. For 2009, WDFW has received authorization to remove all Lyons Ferry stock steelhead returning to the Touchet weir without recycling.

- The goal of summer steelhead production (including the Lyons Ferry and Cottonwood Creek programs and not the Touchet and Tucannon endemic programs) at Lyons Ferry FH is to return 4,656 adult summer steelhead to the project area to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams.

- Based on broodyears 1982-2003, the average smolt-to-adult return rate to the project area for the on-station release (harvest and returns to the hatchery) is 1.7%.

- Based on broodyears 1987-2003, for the Touchet release, the average SAR to the project area is 1.6% (harvest and returns to Lyons Ferry FH).

- Based on broodyears 1989-2003, for the Tucannon release, the average SAR to the project area is 1.4% for the direct stream releases into the lower river (harvest and returns to Lyons Ferry FH and traps on the Tucannon).

- Based on broodyears 1989-2003, for the Walla Walla release, the average SAR to the project area is 1.5% (harvest and returns to Lyons Ferry FH).

- Releases have been reduced through the years in partial response to ESA concerns and documented smolt-to-adult returns (SAR) back to the project area (above Ice Harbor Dam) that far exceed the original SAR goal of 0.5%.

- The Lyons Ferry stock steelhead adults are trapped on-station from volunteers that swim into the fish ladder at Lyons Ferry FH. Fish are held in large adult holding raceways adjacent to the trap until sorting and spawning.

- CO2 is used to anesthetize the adults when sorting fish for retention or to return the fish to the river to be recycled in the fishery.

- MS-222 is used to anesthetize adult steelhead when spawning.

- Spawning occurs from mid-January through mid-February on a weekly basis. Four to five spawn takes occur over this time period.

- Spawning protocol typically calls for a 2:1 male to female spawner ratio (milt and eggs combined together simultaneously), with each male only being used one time. The intent is to increase the genetic diversity (effective population size Ne) of the hatchery-reared population, and ensure successful fertilization of eggs. A 1:1 male to female spawner ratio has occurred for special studies.

- WDFW policy limits options for handling surplus eggs (cannot dispose of eggs), limiting options for spawning to increase the stock's effective population size.

- WDFW follows the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Requirements include testing salmonid broodstock for regulated pathogens that are untreatable and that cause serious mortality (such as IHNV and other viruses). In steelhead

broodstock, tests for reportable pathogens such as *R. salmoninarum*, other bacteria, and parasites (excluding *M. cerebralis*, a regulated pathogen) are not required by policy.

- All females are tested for viruses, including the IHN virus. Depending upon virology results, additional females may be collected for broodstock since eggs from females with high levels of IHNV (_> 10^3 plaque-forming units in cell culture tests) are destroyed

- Due to lower IHN virus detection and improved egg survival over the past few years, the number of females spawned was reduced to 106 to produce approximately 460,000 eyed eggs. This amount is lower than the previous eyed egg goal of 520,000.

- Large bird colonies located on artificial islands in Lake Wallula, near the mouths of the Snake and Walla Walla Rivers and in the downstream reservoirs and Columbia River Estuary consume significant numbers of steelhead, posing an ecological risk to Lyons Ferry stock steelhead. Twenty to thirty percent of PIT tagged Snake River steelhead are reported to be consumed by avian predators in the estuary.[60]

Incubation and Rearing

- The average fecundity of Lyons Ferry stock steelhead is 4,750 eggs per female.

- Eggs in excess to program needs are taken to compensate for the potential presence of IHN and cold water disease during the rearing process.

- Excess fingerlings (up to 50,000) are reared and planted in nearby resident fish lakes (Sprague and Rock lakes). Excess numbers are determined at the time of marking (late August).

- Fertilized eggs are water hardened in 100 ppm iodophore. They are incubated until the eyed-egg stage in down-welling iso-incubation buckets (one female per bucket). Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus includes daily treatment with formalin (1:600). Non-viable eggs and sac-fry are removed by hand picking with egg pickers or bulb-syringe.

- Eggs are shocked after development to the eyed-egg stage. After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs at 1 hatching basket per trough. Eggs from approximately 2 females are loaded in each basket (approx 10,000 eyed eggs). Eggs are inventoried and identified by female parent. Formalin treatment is discontinued once the eggs eye up and are transferred to the hatching baskets.

- Six batteries, including a total of 48 troughs, are used for early incubation in the Lyons Ferry stock program. Flow is on average 8 gallons per minute (6-10 gallons per minute). Maximum rearing densities in the shallow troughs are 1.21 DI (pounds/ft3/average total fish length in inches, Piper et. al.) at 500 fish per pound prior to transfer to outside raceways.

- Incubation, as with rearing, occurs in sediment free, 51-53 degree F (11 C) well water.

- After hatch and swim-up, the steelhead are introduced to feed, and transferred to 5 outside raceways at roughly 500 fish per pound in April (approximately 90,000-95,000 fish per raceway).

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[60] www.birdresearchnw.org. *Dan Robie, OSU principal investigator.*

They are reared in these raceways until marking (tagging is completed later) and transferred to Lake One when they are 40 to 50 fish per pound.

- The flow in the raceways ranges from 500 to 1000 gallons per minute. Flow index in the raceways ranges from 0.03 at initial ponding (500 gpm) to 0.55 (1000 gpm) before the fish are transferred or released.

- Fry/fingerling are fed dry diet. Fry feeding starts at ~3 times daily (7 days per week) and is reduced to 1 time per day (weekdays only) as the fish increase in size. Range of feeding varies between 1.5 – 2.8% of fish body weight per day. Feed conversion is expected to fall in the range of 0.7:1.0 to 1.1:1.0 (dry feed) pounds fed to pounds of fish produced. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance with program goals.

- Green to eye-egg survival for Lyons Ferry stock steelhead is approximately 92%, eye-egg to fry 97-98%, and fry to smolt survival 80-85%.

- The maximum rearing density in the raceways is 0.02 DI (at 4.5 fish per pound). The maximum rearing density in the lake is less than 0.002 DI (at 4.5 fish per pound).

- In August, all Lyons Ferry stock steelhead are adipose-fin clipped and transferred to Lake One. In mid-winter, some of these fish are transferred back to raceways to receive PIT tags, coded-wire tags, and left ventral-fin clips, as determined by WDFW evaluation and Fish Management staff. The fish remain in the raceways until they are loaded into the transport trucks for transfer and release.

- Fish health checks occur at least monthly. Treatment for disease is provided by WDFW Fish Hatchery Specialists (hatchery staff) under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning once per week by brushing, and disinfecting equipment between raceways and/or between stocks on the hatchery site. Mortalities are removed from the raceways daily. The size and depth of the 2.1 acre lakes precludes cleaning other than yearly draining and drying during the summer when fish are removed. Water quality in the lakes is not affected due to low stocking density. Mortalities are rarely observed in the lakes.

- Cold water disease is experienced annually after ponding in the raceways, resulting in a 3.5-4.5% loss of the Lyons Ferry steelhead stock.

- When in the raceways, the juveniles receive medicated feed (florfenicol) when fish mortalities due to cold water disease reach over 100 per raceway per day. Through 2007, fish were treated with "fish pills" coated with florfenicol to provide a 15 mg drug/kg fish weight treatment for 10 days. In the last two years, this treatment is given as florfenicol medicated feed at a lower dose of 10 mg/kg for 10 days, a less efficacious treatment. Disease abates in the raceways before marking occurs and is not a factor in the fish by the time they are transferred to the lake.

Release and Outmigration

- All Lyons Ferry stock steelhead are released as yearling smolts, about 12-14 months after the parents were initially spawned.

- Because the fish are reared on well water, pre-release fish health exams are not performed as per the Washington Co-Managers Salmonid Disease Control Policy.

- All steelhead smolts for the program are planned for a release size of 4.5 fish per pound.

- Length sampling occurs immediately prior to release. The average length of the steelhead reared in the lake are 220mm and 210-215 mm in the raceways. NOAA Fisheries guidelines under the ESA require the release of summer steelhead at lengths ranging from 180 to 250 mm.. Coefficient of variation (CV) for the stock ranges from 8-11%.

- Lyons Ferry steelhead stock transferred for release in the Touchet River are acclimated and released from WDFW's Dayton Pond (river mile 52, downstream from the weir and below most of the natural spawning habitat for steelhead in the Touchet River). The Lyons Ferry stock steelhead transferred to the Tucannon River are direct-stream released at river mile 13, below the primary spawning habitat for the Tucannon natural population. The Lyons Ferry stock steelhead transferred the Walla Walla River are direct-stream released at river mile 35, below most of the spawning habitat for the Walla Walla natural population. WDFW attempts to maintain significant separation between the release locations and where natural spawning is occurring.

- Steelhead produced in the lakes (includes on-station releases and releases into the Tucannon and Touchet rivers) must be transferred to the release structure adjacent to the ladder/trap prior to release. The lakes are drawn down slowly, by removing stop logs. The fish volitionally swim into the outfall, down a pipe and into the release structure. The release structure consists of two 12' x 90' x 4' raceways. The fish come out of the pipe from the lake into the head end of the raceways and can go to either side. The fish (including on station releases) are pumped onto a fish distribution truck and then transported to the release site. Final fish release numbers are enumerated using the calibrated water displacement system of the fish transport units.

- A diesel powered fish pump is used to pump fish onto the fish transport trucks .

- At the time of release the steelhead are sampled at the release structure for weight and length frequency

- At times, during release of steelhead from the lakes, too many fish accumulate into the release structure. The extra fish must be removed and hauled back to the lake.

- To ensure that any potential loss is equally represented among the release sites, the steelhead from the lake are continuously divided up between trucks destined for each site, including the on-station release.

- The steelhead are released on-station shortly after the fall Chinook release.

Facilities and Operations

Lyons Ferry FH

See Lyons Ferry Fall Chinook section for additional information regarding Lyons Ferry FH Facilities and Operations.

- There are three rectangular concrete ponds used for adult holding that are 83x10 with a water depth of 5 feet. Adult steelhead are held in 2 ponds and spring Chinook and/or Touchet and Tucannon stock steelhead in the third pond. These adult holding raceways are enclosed over the middle one-third of the raceway length by the spawning building, where spawning occurs.

- Shallow troughs used for early rearing are 15'x'1 with 0.5' water depth. There are 11 batteries, each with 8 troughs. Two batteries are used for egg isolation. All the troughs operate on a two-pass serial reuse system (the upper 4 of a battery receive fresh water and the lower 4 receive water from the upper 4).

- The raceways used for rearing steelhead are 10x88 with a 3.5' water depth. Flows are 500-1000 gpm.

- One of the three rearing lakes, Lake One, is used for rearing Lyons Ferry stock steelhead. The lake is 2.1-acres. The three large lakes receive 3,500 – 4,200 gpm total providing a good flow with no hydraulic problems.

- Discharge from Lyons Ferry FH complies with all NPDES standards. However, steelhead and spring Chinook spawning effluent are discharged directly into the Snake River.

Dayton Acclimation Facility (Dayton Pond)

- The water right to the Dayton Acclimation Facility is 2,694 gpm (6 cfs) for the period of Jan 1st – May 15th of each year. This water right is held by the Service.

- The Team was unable to determine if the Service is the owner of record for the water right(s) of this facility.

- Although this facility reports water flow in its Monthly Discharge Monitoring Reports as a requirement for its NPDES Permit, water diversions are not adequately measured and reported to meet Service standards for documenting beneficial use and state standards for annual reporting .

- The facility is supplied with water from the Touchet River through a gravity water supply system, with the intake located at the weir/intake diversion dam just upstream of the pond. Water temperatures during use by hatchery staff for steelhead acclimation range from 34 to 52 F.

- The pond at Dayton Acclimation Facility is 209,000 cubic feet.

- The water intake is adjacent to an intake for irrigation.

- The intake screen meets NOAA screening criteria.

- The facility has a high and low water alarm.

- Staff are on site 24/7 when steelhead are being acclimated.

- There is no barrier between the parking lot and the pond. Runoff from the parking lot is carried away from the pond due to the pitch of the asphalt.

- Although there is a perimeter fence for security, there is no bird wire or predation fencing. Bird and mammal predation is not significant at this facility.

Research, Education, and Outreach

- At this time, there is no direct research associated with the Lyons Ferry stock summer steelhead (i.e. time or size at release studies, growth studies, etc.). However, starting in 2008, all Lyons

Ferry stock release groups received PIT tags roughly based on proportional release size and expected number of adults returning (1,500 for the on-station release group and 3,500 each for Walla Walla, Tucannon, and Touchet release groups). Returns from these PIT tagged groups are analyzed separately or as an aggregate to estimate total returns for mitigation accounting purposes. This is partially in response to an anticipated lack of creel personnel in the future to recover coded-wire tags from the summer steelhead fishery.

- 20,000 steelhead are coded-wire tagged with distinct codes per release site. Each representative release group is then held in one of 4 separate raceways.

- Coded-wire tag recoveries have not been adequate for estimating the number of adults returning. Recoveries are less than 5-10%, well below the 20% standard recommended (20% of the fish harvested, according to catch record cards).

- An initiative is being developed among LSRCP comanagers to standardize monitoring and evaluation and create a standardized data management system for data entry and reporting.

- PIT tag recoveries occur at both downstream and upstream facilities and mainstem dams. This includes recoveries at Lyons Ferry FH, PIT tag arrays on the Tucannon and Walla Walla, and at the weirs on the Touchet and Tucannon rivers.

- Coded-wire tag data provides information regarding contribution to fisheries. PIT tag data provides juvenile and adult survival information through the Columbia River basin dams and can be used for in-season harvest adjustments based on adult detections at the dams.

- Past size at release studies were inconclusive. Size/time at release are based upon NOAA fisheries guidelines and fish cultural experience.

- WDFW personnel operate a rotary screw trap in the Tucannon River to estimate the number of migrating natural steelhead smolts and other salmonids.

- As part of its annual broodstock collection and research activities, WDFW hatchery and evaluation staffs operate a series of adult steelhead traps in southeast Washington.

- Evaluation and fish management staffs conduct spawning ground surveys for steelhead in the Walla Walla and Touchet rivers, the Tucannon River, and Asotin Creek.

- WDFW personnel survey steelhead sport anglers within the LSRCP area of Washington in season (September-April) to recover coded-wire tags from steelhead. Catch and effort is not estimated from this survey; however, catch record cards are used to expand coded-wire tag recoveries.

- WDFW used to electrofish index sites to estimate natural juvenile steelhead densities, derive population estimates for specific river reaches, and to estimate residual hatchery steelhead. In addition, mark/recapture tests were conducted to compare with standard electrofishing methods to examine bias in the estimates. These surveys have been discontinued due to the wide variance in population estimates, and their relative lack of use as part of the hatchery evaluation program.

- Since 1998, WDFW's Dayton Lab and Fish Management staffs have periodically collected samples from southeast Washington summer steelhead populations (adult and juvenile) for genetic stock analyses. Samples have been collected from natural-origin steelhead in the Walla Walla, Touchet and Tucannon River basins, the Lyons Ferry hatchery stock, and steelhead in portions of

the Grande Ronde River. During the fall of 2006, a summer steelhead genetics summary was assembled that includes most samples collected through 2005. Many natural-origin steelhead from the Tucannon River were genetically assigned to the Lyons Ferry stock indicating - with other genetic data -, that Lyons Ferry hatchery steelhead have most likely made significant genetic contributions to the Tucannon River population via natural spawning and introgression. In contrast, the genetic data indicate little or no genetic introgression of Lyons Ferry hatchery steelhead in the Walla Wall River population, and relatively small amounts of introgression – if any – in the Touchet River population. The Walla Walla steelhead population appears the most distinct genetically among the Walla Walla, Touchet, Tucannon, and Lyons Ferry steelhead stocks, with the Touchet River population only slightly less distinct than the Walla Wall River population. These genetic results are very consistent with predictions based on field observations of naturally spawning fish.

- Up to100 steelhead adult carcasses are donated to Walla Walla community college for dissection in a biology class.

- Approximately 20 tourists visit the Dayton Acclimation Facility annually.

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[61] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- Annual estimated harvest (expanded from coded-wire tag recoveries) of Lyons Ferry stock steelhead (for all release locations) within the project area for broodyears 2000-2003 averaged 3,069 (range 1,565 to 4,161).

- Annual estimated harvest (expanded from coded-wire tag recoveries) of Lyons Ferry stock steelhead by release location for broodyears 2000-2003 averaged 759 (range 297-1,032) for the Touchet River, 788 (range 325-1,138) for the Walla Walla river, 377 (range 242-593) for the Snake River at Lyons Ferry FH), and 1,146 (range 701-1,621) for the Tucannon River.

- Estimated harvest (expanded from coded-wire tag recoveries) within the project area of Lyons Ferry stock steelhead (for all release locations for broodyears 200-2003) accounted for 75.7% of the total estimated harvest on the stock (24.3% below the project area).

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

[61] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*

- Ongoing hatchery evaluation of rearing protocols, disease histories, feed conversion, and growth and survival rates are used in adaptive management feedback loops to improve hatchery operations. The information is also communicated to the fisheries community and greater public through scientific and management forums.

- Lyons Ferry FH staff cosponsor fishing derbies and provide educational opportunities to school groups and other visitors.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[62] the Review Team identified the following benefits of this program:

Harvest Benefits

- The program confers both sport and tribal harvest benefits in the Columbia River, downstream of the project area. Tribal harvest primarily occurs in zone 6 fisheries (between the Snake River confluence and Bonneville Dam) in the summer when summer Chinook, fall Chinook, and coho are also harvested.

- Annual estimated harvest (expanded from coded-wire tag recoveries) of Lyons Ferry stock steelhead (for all release locations) below the project area for broodyears 2000-2003 averaged 783 (range 324 to 1,132).

- Estimated harvest (expanded from coded-wire tag recoveries) below the project area of Lyons Ferry stock steelhead (for all release locations for broodyears 200-2003) accounted for 24.3% of the total estimated harvest on the Lyons Ferry stock (75.7% within the project area).

- Estimated harvest (expanded from coded-wire tag recoveries) of Lyons Ferry stock steelhead, (for all release locations for broodyears 200-2003) below the project area occurred in the ocean (0.1%) net (2.4%) and sport (21.8%) fisheries.

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Tribal harvest provides subsistence and cultural benefits to the Columbia River tribes.

- Hatchery staff provide educational opportunities offsite to other communities.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[63] the Review Team identified the following risks of the hatchery program:

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[62] *Ibid.*

Genetic Risks

- Current spawning protocols could lead to some level of domestication selection due to sperm competition among males.

- The effective number of breeders is comparatively small to sustain the program over the long term.

Demographic Risks

- High densities during early rearing (when the steelhead are in the shallow troughs) may contribute to cold water disease later when the steelhead are reared in the raceways.

- Lack of shade covers over the raceways concentrates fish in shaded areas along raceway walls during summer months, increasing effective densities, potential stress, and disease risks. This is not applicable to rearing steelhead in the large lakes.

- Crowding and loading of fish onto trucks for transportation to release sites poses risks that do not occur with on-station releases. This extra handling associated with transportation may physically harm the fish, which may be contributing to increased post-release mortality.

- Transportation to release sites poses a demographic risk to the stock during transport and unknown physiological (stress) risks during transport and following release.

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in the steelhead raceways.

- The four Columbia River and two Snake River dams significantly reduce the survival of outmigrating juveniles and returning adults, posing a demographic risk to the return of sufficient numbers of adults for harvest on a consistent basis.

Ecological Risks

- Amplification of disease within the hatchery poses a disease risk to the propagated stock.

Physical Risks

- See the Lyons Ferry fall Chinook section

Research, Education, Outreach and Cultural Risks

- Steelhead removed from Lake One, coded-wire and PIT tagged, then reared in raceways may not accurately represent their respective production groups at the time of release because they are reared in different containers (lake versus raceway).

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

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[63] *Ibid.*

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[64] the Review Team identified the following risks from the hatchery program:

Genetic Risks

- Lyons Ferry steelhead released into the Tucannon River pose significant genetic risks to the natural-origin Tucannon River steelhead population due to the high proportion of naturally spawning Lyons Ferry stock steelhead. Interbreeding between Lyons Ferry FH stock steelhead released in the Tucannon River and natural origin steelhead may be reducing productivity and fitness within the natural Tucannon River population.

- Outplanting Lyons Ferry stock steelhead into the Touchet and Walla Walla rivers poses genetic risks to natural populations; however, those risks appear to be lower than in the Tucannon River because a smaller proportion of potentially naturally spawning fish are hatchery origin (Lyons Ferry stock).

- The lower sections of the Walla Walla and Touchet rivers may be impassable to returning Lyons Ferry steelhead in August and September because of low flows and thermal barriers. The Lyons Ferry hatchery stock has an earlier return timing than natural populations in the Walla Walla and Touchet rivers. Low flows and warm temperatures in those two rivers during the late summer could contribute to straying by Lyons Ferry hatchery-origin fish. Low flows due to irrigation withdrawals may prevent both hatchery and natural-origin steelhead from entering the Walla Walla and Touchet rivers until January of some years (Glen Mendel WDFW personal communication).

- Presumed interbreeding between Lyons Ferry hatchery steelhead released in the Tucannon River and natural origin steelhead may be reducing the productivity and viability of the naturally spawning population.

Demographic Risks

- The incidental hooking mortality of endemic hatchery stock and natural-origin steelhead and local populations of redband rainbow trout in fisheries targeting Lyons Ferry stock steelhead poses demographic risks to those non-targeted stocks.

- Harvest targeting Lyons Ferry stock steelhead poses a demographic risk to bull trout.

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in raceways used for other species or stocks.

Ecological Risks

- The release of untreated effluent from the spawning area poses health and potential water quality risks to fish and other species downstream of Lyons Ferry FH.

- The transfer and release of Lyons Ferry stock steelhead pose inherent ecological risks (e.g. competition, predation, disease) to natural-origin steelhead and local populations of redband

[64] *Ibid.*

rainbow trout in the basin in which they are released. This risk is reduced by releasing full-term smolts from locations with adult recapture facilities.

- Since steelhead are more likely to residualize than hatchery-reared salmon stocks, ecological risks are increased.

- Steelhead that residualize pose ecological risks to other species including bull trout.

- The collection and barging of steelhead smolts at mainstem Snake River and Columbia River dams pose a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program[65]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue LF-SS1: Based upon the history of the Lyons Ferry stock steelhead program, harvest downstream of the project area is much lower than the assumptions used to establish project area harvest goals. *Current mitigation and, subsequently, harvest goals have been based upon the assumption that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project*

[65] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

area (presumed 1:1 catch ratio). Harvest data (broodyears 2000-2003) indicates that 75.7% as opposed to 33% of the returning Lyons Ferry steelhead are harvested in the Snake River project area.

Recommendation LF-SS1: Continue to size the program based upon current and anticipated harvest regimes. Restate program goals in management documents based upon current and anticipated returns and harvest.

Broodstock Choice and Collection

None identified

Hatchery and Natural Spawning, Adult Returns

Issue LF-SS2a: The pooled spawning of two males with one female reduces the genetic effective number of breeders and potentially imposes some level of artificial selection for life-history traits that are correlated with sperm potency.

Issue LF-SS2b: The effective number of breeders per year is minimal.

Recommendation LF-SS2: Continue to spawn two males with every female, but subdivide the eggs of each female in approximately equal proportions and fertilize each subgroup separately with a different male. The two subgroups from a female can be combined after approximately one minute to increase fertilization rates, if desired.

Issue LF-SS3: The proportion of Lyons Ferry stock hatchery-origin adults allowed access to the lower extent of the primary spawning area on the Tucannon River (below river mile 36) is high. *The estimated annual spawning escapement for the Tucannon River is 600-800 adult steelhead, with 60-70% of hatchery origin (10-20% endemic and 50% Lyons Ferry stock). Analyses indicate that there may be significant genetic introgression of Lyons Ferry stock steelhead into the naturally-spawning population in the Tucannon River.*

Recommendation LF-SS3: Either (a) reduce the number of Lyons Ferry hatchery steelhead spawning naturally in the Tucannon River to less than 5% of the total number of steelhead spawning annually, or (b) discontinue the release of Lyons Ferry steelhead in the Tucannon River. This will require modifications to the temporary weir located below the lower extent of the primary spawning habitat (river mile 25) because the existing weir is not a good exclusion mechanism (see Issue and Recommendation TR-SS11 in the Tucannon River steelhead section). Also, discontinue the practice of recycling Lyons Ferry steelhead in the Tucannon River.

Issue LF-SS4: Lyons Ferry hatchery-origin compose greater than 5% of the adult steelhead that escape to the spawning grounds on the Touchet River. *Improvements have been made to the weir located below the spawning grounds in attempt to increase the ability to exclude upstream passage of hatchery-origin adults.*

Recommendation LF-SS4: Continue to monitor spawning escapement upstream of the Touchet River weir to ensure that Lyons Ferry stock steelhead compose less than 5% of the adult steelhead upstream of the weir. If this latter proportion is greater than 5%, then consider

either (a) additional improvements to the weir or (b) reductions in the number of Lyons Ferry steelhead released into the Touchet River.

Issue LF-SS5: The continued release of an out-of-basin stock into the Walla Walla River poses genetic and ecological risks to the naturally spawning steelhead population in the Walla Walla River. *However, the proportion of hatchery-origin adults escaping to the spawning grounds in the Walla Walla River, exclusive of the Touchet River, appears to be below the 5% threshold.*

Recommendation LF-SS5: Continue to monitor the composition of steelhead spawning naturally (hatchery and natural) in the mainstem Walla Walla River to ensure that the 5% threshold is not exceeded.

Incubation and Rearing

Issue LF-SS6: All steelhead female broodstock are tested for IHNV. The progeny from the females with virus titers of <10^4 pfu/ml (in the ovarian fluid) are kept for rearing. Management practices have improved adult returns so there is less need to keep excess progeny that may be infected with IHNV.

Recommendation LF-SS6: Cull progeny from all females that are positive for IHNV.

Issue LF-SS7a: Rearing densities in the indoor nursery tanks "shallow troughs" (1.21 max DI) exceed culture guidelines for steelhead, thus increasing fish health risks. *Due to space limitations in the intermediate and outdoor raceways, steelhead are held in the troughs beyond the recommended maximum rearing density index (D.I.) for steelhead (D.I. <0.5). This protocol results in density indexes attaining D.I. = 1.21 in the indoor nursery tanks prior to transfer to the outdoor raceways.*

Issue LF-SS7b: High rearing densities during early rearing may be contributing to the later onset of cold water disease.

Recommendation LF-SS7: Reduce rearing densities in the shallow troughs to a maximum of D.I. = 0.5 by increasing the number of nursery rearing or intermediate rearing tanks (see LF-SS12), by reducing the total number of Lyons Ferry steelhead reared, by reducing the number of fish reared in other programs, or by reducing the total number of stocks reared at Lyons Ferry FH.

Issue LF-SS8: Delayed treatment of coldwater disease may make it difficult to control mortality associated with the progression of the disease. *Coldwater disease causes 3.5-5% mortality in the Lyons Ferry stock steelhead annually. When fish mortalities reach about 100 per raceway per day, they are treated with medicated feed (florfenicol). Formerly, fish were fed pills coated with 15 mg drug/kg of fish weight as prescribed by a veterinarian. New regulations now require the use of florfenicol medicated feed at 10 mg drug/kg fish weight with a Veterinary Feed Directive. The medicated feed is less effective in controlling disease and delivery time from the feed company is slow, resulting in less efficacious treatment.*

Recommendation LF-SS8: Test the therapeutic value of early fluorfenicol treatment by comparing treated and untreated (control) fry in the shallow troughs (i.e., before coldwater

mortality starts). In conjunction with this, test new diagnostic methods (e.g., PCR, QPCR) and/or culturing alternate tissues (such as brain) for earlier detection of cold water disease to ascertain if medication is warranted prior to ponding into the raceways. Also consider investigating different densities (1.21, 0.5, and 0.2 DI) of fry in the troughs to determine whether early rearing densities influence the development of coldwater disease. Continue working with the Bacterial Coldwater Disease Research Group, as supported by the Pacific Northwest Fish Health Protection Committee, to develop fish culture practices and treatment options to control or eliminate coldwater disease.

Release and Outmigration

Issue LF-SS9: Pre-release exams which include testing for virus, bacteria and parasites are not done at the Lyons Ferry FH Complex and associated acclimation sites. *There is a potential risk that endemic or vertically transmitted diseases might be undetected in released juveniles. This could affect their future survival and/or infected fish could serve as vectors for infecting other aquatic animals . Pre-release inspections, conducted 4-6 weeks before release or transfer are required by USFWS fish health policy FW 713 713 and the Integrated Hatchery Operations Team (IHOT) Policy and Procedures.*

Recommendation LF-SS9: Sample 60 fish for pre-release inspections to meet the American Fisheries Society – Fish Health Section Blue Book requirements to ensure a 95% confidence in detecting pathogens at the minimum assumed pathogen prevalence level of 5%. Additional testing for non-reportable pathogens, such as *Flavobacterium psychrophilum* and *Nucleospora salmonis*, may be informative for co-managers.

Issue LF-SS10: Crowding, loading and transport is stressful to fish and may affect post-release survival. *Fish within raceways and lakes are crowded and pumped into transport trucks for direct-stream release. The level of stress in the fish and oxygen content in raceways and lakes during crowding and loading of the trucks has not been assessed.*

Recommendation LF-SS10: Assess the level of stress and oxygen content in the water in the raceways and lakes during crowding and loading and assess post release survival 24 to 48 hours after release to ensure that there are no issues. Take actions based on results of studies to reduce stress points.

Facilities/Operations

Lyons Ferry FH

(See the Lyons Ferry FH Fall Chinook section for additional facility issues and recommendations)

Issue LF-SS11: The number of stocks reared at Lyons Ferry FH is not consistent with the design of the facility. *This creates the potential for exceeding maximum rearing densities in raceways that are over loaded, and adds complexity to marking schedules and evaluation. Lyons Ferry FH, with its few, large rearing containers, was designed to produce a large number of a few stocks of fish. Endangered Species Act considerations have led to the development of multiple endemic hatchery programs (each with a specific stock to be reared) tailored to conserve threatened natural populations and to provide harvest opportunities where non-endemic stocks have historically been released. Additionally, Lyons Ferry FH is authorized under the LSRCP to rear catchable rainbow trout for Washington and Idaho lake fisheries. In addition*

to the 2 stocks of rainbow trout 7 salmonid stocks are reared at Lyons Ferry FH (Lyons Ferry fall Chinook, Tucannon spring Chinook, Lyons Ferry steelhead, Wallowa steelhead, and Tucannon and Touchet endemic program steelhead) with several distinct tag groups associated with release locations, creating several lots that must be reared separately.

Recommendation LF-SS11: Reduce the number of stocks reared at Lyons Ferry FH or modify Lyons Ferry FH so that it can appropriately accommodate the number of programs. One option may be for LSRCP to provide funding for rearing rainbow trout at an existing Washington State trout hatchery. Facility modification options brought to the attention of the Team include:

- Dividing the three lakes into multiple rearing ponds.
- Dividing the adult holding containers.
- Expanding early rearing space (LF-SS12).
- Establishing water heating/chilling capacity to appropriately manipulate production.

Issue LF-SS12: Existing early rearing space is not sufficient for the numbers and types of fish reared at Lyons Ferry FH resulting in high densities during early rearing (see LF-SS7a).

Recommendation LF-SS12: Consult with Engineering to increase early rearing capacity by modifying the existing, underutilized tank pad formerly used for captive brood production. Include multiple rearing vessels and, at a minimum, cover the area with a shed roof to provide shade and protection.

Issue LF-SS13: The discharge of untreated effluent from the steelhead and spring Chinook spawning area directly into the Snake River poses a fish health risk and potential water quality risk to fish and other species downstream of Lyons Ferry FH. *The health risk is increased since adults are transferred from other watersheds and may not maintain the same disease profile as returns to Lyons Ferry.*

Recommendation LF-SS13: As a best management practice, investigate retaining or redirecting spawning effluent to the pollution abatement pond or to a special containment area with possible effluent disinfection.

Dayton Acclimation Pond

Issue LF-SS14: The Lower Snake River Compensation Plan office is reviewing the ownership status of water rights associated with all the facilities which divert water for fish production that are operated by the comanagers. *Although ownership of several of the facilities has been transferred to the Service, the appropriate documentation to transfer the water rights may not have been filed in the respective state agency which administers water rights. Moreover, facility staff may not consistently or adequately record water use to ensure documentation of beneficial use in support of its water right(s) and as required by state law . Adequate documentation and reporting are required to maintain the right to divert water.*

Recommendation LF-SS14: Work with the Lower Snake River Compensation Plan office to ensure water diverted to Dayton Acclimation Pond for fish production is measured and

reported correctly and the information is maintained by the Service's, Region 1 Engineering, Division of Water Resources.

Research, Monitoring, and Accountability

Also see issue and recommendation LF-FC24, 25, and 26 in the Lyons Ferry Fall Chinook section above.

Issue LF-SS15: Steelhead in the Tucannon River (natural-origin steelhead and Tucannon endemic and Lyons Ferry stock steelhead released into the Tucannon River) have a high degree of straying upstream of Little Goose and Lower Granite dam and into tributaries including Asotin Creek(?). *Off-site releases of hatchery reared salmon and steelhead (regardless as to whether they were acclimated or direct stream released) have consistently demonstrated reduced homing abilities in returning adults (Evenson 1992, Vander Haegen 1995, Johnson 1990). Current hatchery practices may be contributing to these stray rates, including the practice of rearing the fish to smolt stage at Lyons Ferry FH, then transporting them and direct stream releasing them in the Tucannon River, posing genetic and ecological risks to other steelhead stocks. Facilities at mainstem dams to accommodate passage of migrating adults both upstream and downstream may also be inadequate.*

Recommendation LF-SS15a: Continue to investigate the degree of homing and straying and experiment with rearing and release strategies to reduce straying. Investigate the feasibility of incubating and rearing Tucannon steelhead at the Tucannon FH to increase homing and reduce straying.

Recommendation LF-SS15b: Continue to investigate safe passage of adult steelhead, both upstream and downstream of mainstem dams.

Issue LF-SS16: Coded-wire tagged fish (including other marking strategies such as PIT tagging) may not accurately represent each release group from Lyons Ferry FH. *Steelhead removed from Lake One, coded-wire and PIT tagged, then reared in raceways may not accurately represent their respective production groups at the time of release because they are reared in different containers (lake versus raceway). Because the fish in different rearing containers can differ (e.g., size and behavior) and the container environments can differ (e.g., flow index and flow pattern), tagging fish and rearing them in containers separate from the rest of the production group may not represent the entire release group for that year.*

Recommendation LF-SS16: Ensure that the tagging strategy accurately represents each respective production group. For example, all spawn groups should be proportionately represented among tag groups and raceways. This recommendation applies to any marking strategy, including PIT tags.

Issue LF-SS17: Counts of returns to the project area (harvest, hatchery and spawning grounds) are critical to evaluating the program. *The current coded-wire tag sampling rate does not meet coast-wide standards in all fisheries and does not accurately account for adult returns harvested. Sampling rates are less than 5-10%, well below the 20% standard advocated by the Lower Snake River Compensation Plan Coordinator (20% of the fish harvested, according to catch record cards). The use of PIT tags is increasing to compensate for this inadequacy. PIT tag arrays may be insufficient to provide accurate estimates for the number of returning adults, escapement to the spawning grounds, and straying.*

Recommendation LF-SS17: WDFW should continue to work with comanagers to assess the mark sampling program with the goal of increasing the percent of CWTs recovered in terminal fisheries. Alternatively, continue prospecting the use of PIT tags in combination with coded-wire tags to compensate for the low coded-wire tag sampling rate.

Education and Outreach

See the Lyons Ferry Fall Chinook section for Education and Outreach issues and recommendations regarding Lyons Ferry FH.

Alternatives to Current Program

The Review Team considered the benefits and risks of the existing B-run steelhead program at Clearwater FH and developed seven alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

Alternative 1: Current program with recommendations

This alternative includes maintaining a *pHOS* of less than 5% in rivers where Lyons Ferry hatchery steelhead are outplanted, consistent with the management of natural populations native to those streams (Tucannon, Touchet, and Walla Walla). For the Tucannon River, an efficient weir must be established in the Tucannon River below the primary spawning areas to prevent Lyons Ferry stock access to those areas, or the releases of Lyons Ferry hatchery steelhead into the Tucannon should be discontinued.

Pros

- Reduces the large proportion (10-20%) of Lyons Ferry adults spawning in primary production areas within the Tucannon River.
- Maintains mitigation harvest opportunities on Lyons Ferry stock steelhead in the Walla Walla River basin and Snake River.
- Weir improvements on the Touchet River are expected to reduce the proportion of naturally spawning steelhead composed of Lyons Ferry steelhead below 5% in the natural spawning area upstream of the Touchet River weir.

Cons

- May not reduce the proportion of Lyons Ferry stock spawning in the Tucannon River to less than 5% without an efficient weir below the primary spawning area in the Tucannon River.
- Requires a significant investment in infrastructure if an improved weir in the lower Tucannon River is constructed.

- Lyons Ferry steelhead released in the Touchet and Walla Walla rivers appear to stray to areas upstream of Lower Granite Dam.

- Additional monitoring in the Walla Walla River may be necessary to assure the proportion of Lyons Ferry stock in the natural spawning areas is less than 5%.

- Reduces harvest opportunity in the Tucannon River.

- Continues disease transmission risks from Lyons Ferry steelhead to natural populations in the Touchet, Tucannon and Walla Walla rivers.

Alternative 2: Terminate all releases of Lyons Ferry stock steelhead in the Tucannon, Touchet, and Walla Walla rivers and replace with increased on-site releases of Lyons Ferry steelhead from Lyons Ferry FH and/or with larger-sized endemic programs for the off station releases in the Tucannon and Touchet rivers.

This alternative would restrict releases of Lyons Ferry stock steelhead to Lyons Ferry FH. On-station releases could be increased to compensate for the termination of off-station releases (i.e. outplanting), or the additional space could be used for expanding the endemic programs for off-station releases. This alternative leaves open the option for expanded Touchet and Tucannon endemic programs or, as a third possibility, for reallocating mitigation releases to other sites (Grande Ronde River, etc.) .

Pros

- Eliminates Lyons Ferry adults spawning in primary production areas within the Tucannon, Touchet, and Walla Walla rivers, unless straying occurs to those areas from on-station releases at Lyons Ferry FH.

- Maintains mitigation harvest opportunities on Lyons Ferry stock steelhead in the Snake River.

Cons

- Lyons Ferry stock steelhead releases stray above Lower Granite Dam and may be spawning in natural production areas.

- May reduce mitigation harvest opportunities in the lower Tucannon, Touchet, and Walla Walla rivers, especially if larger-sized endemic programs are not implemented.

Alternative 3: Terminate the Lyons Ferry steelhead stock and replace with an indigenous Snake River stock.

This alternative can be combined with some elements of alternatives 1 or 2. This alternative would replace the existing "out-of-basin" Lyons Ferry stock with another hatchery stock developed from steelhead indigenous to the Snake River. The goal of this alternative is to reduce straying risks, improve productivity, follow guidelines for "best management practices", while continuing to return sufficient numbers of adult steelhead to meet LSRCP mitigation goals for harvest. Candidate steelhead stocks for on-station releases include Tucannon River, Touchet River, Little Sheep Creek (ODFW),

Wallowa Hatchery (ODFW), Oxbow Hatchery (IDFG), and Dworshak National Fish Hatchery ("B-run") steelhead (USFWS). The Team did now weigh the pros and cons of specific alternative stocks. The Team assumed such discussions should be deferred to comanagers. However, some members of the Team expressed strong sentiment against the release of Wallowa Hatchery steelhead at Lyons Ferry Hatchery, including the potential expanded release of that stock elsewhere, because of the documented high straying rate of Wallowa Hatchery steelhead into the Deschutes and John Day rivers.

Pros

- Is expected to continue to provide mitigation harvest benefits to Washington in the Snake River.
- Utilizes an in-basin, Snake River stock of steelhead consistent with best management practices and fish culture guidelines.
- Is expected to reduce straying risks of hatchery-origin steelhead to populations upstream of Lower Granite Dam.
- Reduces the number of stocks reared at Lyons Ferry FH if on-station releases are restricted to Tucannon and Touchet river stocks.

Cons

- Would replace a hatchery stock that appears to be very successful at returning adults back to the Lower Snake and Walla Walla rives for harvest.
- The potential use of the Wallowa Hatchery stock for onsite releases of steelhead at Lyons Ferry FH would increase straying risks to natural populations in downstream tributaries (e.g., Deschutes River).
- May increase fish health risks at Lyons Ferry Hatchery depending on the selected stock.
- Use of the Tucannon stock for on-site releases at Lyons Ferry Hatchery would depend on the successful development and expansion of the current endemic Tucannon River steelhead program.

Alternative 4: Terminate the Lyons Ferry program (and stock) and increase steelhead production at a location(s) upstream of Lower Granite Dam (e.g. Grande Ronde River, Little Salmon River)

Pros

- Eliminates Lyons Ferry adults spawning in primary production areas within the Tucannon, Touchet, and Walla Walla rivers, unless straying occurs to these areas from on-station releases.
- Continues to provide mitigation harvest opportunities for Washington in the Snake River.
- Reduces the number of stocks reared at Lyons Ferry and significantly increases rearing space.

Cons

- Significantly reduces mitigation harvest opportunities in the lower Tucannon, Touchet, Walla Walla rivers.

- Length of harvest opportunities may be reduced in the mainstem Snake River since adults will return to upstream collection facilities.

- May require significant investments in infrastructure to create/modify facilities to accommodate this program.

Alternative 5: Terminate the Lyons Ferry steelhead program and use the space at Lyons Ferry FH for Chinook and endemic steelhead programs

Pros

- Increases the amount of rearing space available for other programs, including larger-sized endemic programs.

- Reduces the number of stocks reared at Lyons Ferry.

Cons

- Significantly reduces mitigation harvest opportunities in the lower Tucannon, Touchet, Walla Walla rivers unless larger-size endemic programs are implemented.

- May not meet LSRCP harvest mitigation requirements for Snake River basin steelhead above Lower Granite Dam even if larger-sized endemic programs are implemented.

Recommended Alternatives

Short term goal - The Team favors the immediate implementation of Alternatives 2 and applicable elements of Alternative 1: (1) terminate off-station releases of Lyons Ferry steelhead into the Tucannon, Touchet and Walla Walla rivers, (2) expand the Tucannon and Touchet river endemic programs and/or increase the number of steelhead released on-site from Lyons Ferry Hatchery, and (3) implement all elements of Alternative 1 that apply to the on-station releases. These short-term goals and recommendations are consistent with the recommendations for the endemic steelhead programs in the Tucannon and Touchet rivers (see following sections). .

Long-term goal- Implement Alternative 3: Replace the Lyons Ferry stock of steelhead with a stock indigenous to the Snake River The Team concluded that the out-of-basin Lyons Ferry stock is inappropriate for long-term use in the Snake River Basin. Potential candidate stocks are listed in the narrative for Alternative 3. The pros and cons of each of those candidate stocks would need to be evaluated by comanagers before a specific stock is selected.

Cottonwood Creek Hatchery Summer Steelhead

Operator: Washington Department of Fish and Wildlife

Summary of Current Program

Goals

- ***Harvest goal:*** Provide sport and tribal fishing opportunities for summer steelhead in the Grande Ronde River. There is currently no quantified "harvest" goal for this program separate from the LSRCP adult mitigation return goals. The intent of the program is to return 1,501 summer steelhead to the project area for harvest and broodstock collection. In this case, return goals are equivalent to harvest goals. This LSRCP mitigation goal was based on the assumption that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (presumed 1:1 catch ratio).

- ***Broodstock escapement goal:*** Collect a minimum of 150 hatchery-origin (marked) adult steelhead (50 females and 100 males) for broodstock from March through April on Cottonwood Creek (tributary to the Grande Ronde River).

- ***Conservation goal:*** The program currently has no specific conservation goal.

- ***Escapement goal for natural-origin adults:*** Interim minimum abundance thresholds developed by the ICTRT for natural origin steelhead in the project area are as follows.

Lower Grande Ronde	A	Intermediate	1,000
Joseph Creek	A	Basic	500

The recovery goals for the lower Grande Ronde River and Joseph Creek are 1000 and 500, respectively.

The interim restoration goals from the Snake River Salmon Recovery Plan are:

Lower Grande Ronde	1,855 – 5,101
Joseph Creek	2,149 – 5,909

(pers. comm. Glen Mendel, WDFW, 2009)

- ***Research, education, and outreach goals:*** Provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Lyons Ferry FH and LSRCP programs. The Dayton Lab monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex

Objectives

- Collect and spawn a minimum of 50 females to produce approximately 220,000 green eggs which results in approximately 160,000 smolts for release from the Cottonwood Creek acclimation pond

into the Grande Ronde River. Depending upon virology results, additional females may be collected for broodstock.

Program Description

The Wallowa Stock (currently used by both WDFW and ODFW) steelhead was originally derived in the early 1980's from trapping steelhead at Ice Harbor and Little Goose dams. The stock is therefore likely made up of both "A" and "B" run steelhead from the Snake River basin, and could include fish from Clearwater, Salmon and Grande Ronde basins. A permanent adult trapping site was installed in Cottonwood Creek to trap hatchery broodstock beginning in 1992. Prior to that and for a few years following, WDFW received eggs from ODFW in order to reach program goals. [2005 Wallowa Stock Summer Steelhead HGMP, P 32]

The Wallowa stock program was initiated to provide a sport fishery for summer steelhead in the Grande Ronde River (for both Oregon and Washington anglers). It has been an extremely successful program in that regard, and adult returns have warranted a program reduction from a 250,000 yearling release goal to the current program of 160,000 yearlings (the reduction occurred in 2003). Due to successful SAR survival, another program reduction may be an option to reduce the number of excess returning adults. [Lyons Ferry FH Complex Annual Operations Plan 2008-2009, P 26]

Trapping of returning Wallowa stock adults occurs on Cottonwood Creek (a small tributary to the Grande Ronde River) beginning in March each year. This creek also supplies water to the Cottonwood AF. Trapping occurs from March through April. Unmarked steelhead are not retained for spawning, but passed upstream to spawn naturally. All spawned carcasses are taken above the trap in Cottonwood Creek and scattered for nutrient enhancement, or returned to Lyons Ferry FH to be buried. [Lyons Ferry FH Complex Annual Operations Plan 2008-2009, P 26] The adult holding area is limited, so we allow generally no more than 300 adults to be held at any one time. Additional fish that arrive and are not needed for broodstock are passed upstream to spawn naturally. All coded-wire tag fish are retained and are either spawned or killed outright to obtain the tag information (pers. comm. J. Bumgarner, WDFW, 2009).

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- The Wallowa Stock (currently used by both WDFW and ODFW) steelhead was originally derived in the early 1980's from trapping steelhead at Ice Harbor and Little Goose dams. The stock is therefore likely made up of both "A" and "B" run steelhead from the Snake River basin, and could include fish from Clearwater, Salmon and Grande Ronde basins. .

- A permanent adult trapping site was installed in Cottonwood Creek to trap hatchery broodstock beginning in 1992. Since then, fish for this program have been collected at the Cottonwood Creek trap.

- Prior to 1992 and occasionally in following years (includes years where there was lack of water in Cottonwood Creek) WDFW received eggs from ODFW's Wallowa Hatchery in order to reach program goals.

- NOAA Fisheries excluded this stock from any existing ESUs.

- The program is managed as segregated. Wallowa stock hatchery steelhead, that are identified by a mark (adipose-fin clip and left ventral clip or adipose-fin clip only) are used for broodstock. Based on coded-wire tag recoveries, it is assumed that the adipose-fin clip only fish are Wallowa stock hatchery steelhead.

- Wallowa stock steelhead adults are trapped in the trap on Cottonwood Creek from March 1 through the end of April.

Hatchery and Natural Spawning, Adult Returns

- The Wallowa steelhead stock (both from WDFW's Cottonwood Pond and ODFW's Wallowa Hatchery) has been identified as a stock that strays proportionately more than other stocks into downstream Columbia River tributaries, including the upper reaches of the Deschutes and John Day rivers.[66] Once in the Snake River, the Wallowa stock appears to have high homing fidelity back to the Cottonwood Acclimation Facility.

- The goal of summer steelhead production (including the Lyons Ferry and Wallowa Stock programs and not the endemic programs) at Lyons Ferry FH is to return 4,656 adult summer steelhead to the project area to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams.

- Based on broodyears 1984-2003, the average smolt-to-adult return rate to the project area (harvest and returns to the adult trap) is 1.85%.

- Releases have been reduced from a release of 250,000 to 160,000 smolts through the years in partial response to ESA concerns and documented smolt-to-adult returns (SAR) back to the project area (above Ice Harbor Dam) that far exceed the original SAR goal of 0.5%.

- Unmarked steelhead, assumed to be natural origin and hatchery steelhead not retained for broodstock are passed upstream of the Cottonwood Creek adult trap. Approximately, 10-50 unmarked steelhead, assumed to be natural origin and 800-2,000 hatchery steelhead are encountered at the trap and passed upstream annually. Additionally, high flows allow for some uncontrolled passage of steelhead.

- Anadromous fish passed above the trap in Cottonwood Creek can be infected with the IHN virus, serving as a potential source of infection to the adults held in the trap and the juveniles reared in the acclimation pond (the intake for the acclimation pond is located at the adult trap)

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[66] *Carmichael and Hoffnagle (2006). Hand and Olson (2004).*

- Adults are collected throughout the run and held in the trap. Up to 300 adults are held in the trap before spawning. .

- WDFW policy limits options for handling surplus steelhead. Currently, staff are not able to remove surplus returns unless they are purposed (e.g. for food banks, distributed to the tribes for subsistence, etc.).

- According to the 2008-2009 Lyons Ferry FH complex AOP, a proposal to kill all marked, unspawned surplus fish for broodyear 09 may be implemented by AOP committee following release of this report. Any unmarked fish will continue to be passed upstream.

- WDFW policy also limits options for handling surplus eggs (cannot dispose of eggs), limiting options for spawning to increase the stock's effective population size.

- Natural spawning capacity has not been estimated for Cottonwood Creek. Cottonwood Creek is not managed for natural production.

- All fish are spawned at the Cottonwood Creek trap site from the last week in March through the first two weeks of April, with the gametes transported to Lyons Ferry FH for fertilization, incubation, and rearing. The goal is to take all eggs within three egg takes.

- If low water flows in the creek do not allow returning adults access to the trap, two alternate strategies may be employed. First, the acclimation pond outlet creek can be modified to allow adult capture there. Second, excess adults from ODFW's Wallowa Hatchery may be used to provide eggs for this program, as occurred in 2005.

- 100 males are collected for broodstock to ensure enough ripe males are available to achieve a 1:1 spawning ratio. Spawning protocol typically calls for a 1:1 male to female spawner ratio, combining milt and eggs from a single male and female in a container, but at times a 2:1 spawner ratio is necessary when there are an insufficient number of ripe males available. The intent is to increase the genetic diversity (effective population size Ne) of the hatchery-reared population, and ensure successful fertilization of eggs.

- MS-222 is used to anesthetize adult steelhead when spawning.

- Survival of gametes collected from Cottonwood has increased substantially in recent years due to a change in spawning protocols. Mortality to eye-up is now averaging about 5%, where it used to be 25-30%. Eggs were transported without their ovarian fluid. Now eggs are shipped in zip lock bags with their ovarian fluid.

- Wallowa stock steelhead females from Cottonwood Creek Adult Trap have averaged 5,200 eggs (250/oz) between the 1997 and 2001 spawning years (Total Samples= 561 females).

- WDFW follows the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Requirements include testing salmonid broodstock for regulated pathogens that are untreatable and that cause serious mortality (such as IHNV and other viruses In steelhead broodstock, tests for reportable pathogens such as *R. salmoninarum*, other bacteria, and parasites (excluding *M. cerebralis*, a regulated pathogen) are not required by policy.

- All females are tested for viruses, including IHNV. Depending upon virology results, additional females may be collected for broodstock since eggs from eggs from females with high levels of IHNV (_> 10 ^{3} plaque-forming units in cell culture tests) are destroyed.

- Due to lower IHN virus detection, improved egg survival over the past few years, ESA concerns, and high SARs, the program and consequently the number of females spawned was reduced to 50 to produc^{e} approximately 220,00 green eggs. This amount is lower than the previous egg goal of 400,000.

- Large bird colonies on artificial islands located on artificial islands in Lake Wallula, near the mouths of the Snake and Walla Walla Rivers and in the downstream reservoirs and Columbia River Estuary consume significant numbers of steelhead, posing an ecological risk to Wallowa stock steelhead. 23% of PIT tagged Snake River steelhead are reported to be consumed by avian predators in the estuary.[67]

Incubation and Rearing

- Eggs in excess to program needs are taken to compensate for the potential presence of IHN and cold water disease during the rearing process.

- Excess fingerlings are (up to 50,000) are reared and planted in area lakes (Sprague and Rock lakes). Excess is determined at time of marking (late August).

- Fertilized eggs are water hardened in 100-ppm iodophore. They are incubated until the eyed-egg stage in down-welling iso-incubation buckets (one female per bucket). Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus includes daily treatment with formalin (1:600). Non-viable eggs and sac-fry are removed by hand picking with egg pickers or bulb-syringe.

- After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs at 1 hatching basket per trough. Eggs from approximately 2 females are loaded in each basket (approx 10,000 eyed eggs). Eggs are inventoried and identified by female parent. Formalin treatment is discontinued once the eggs eye up and are transferred to the hatching baskets.

- The Wallowa steelhead stock are ponded in the troughs after the Lyons Ferry stock steelhead are moved out of the incubation building in early April.

- 3 batteries (22 of the 24 troughs) are used for early incubation in the Wallowa stock program. Flow is on average 8 gallons per minute (6-10 gallons per minute). Maximum rearing densities in the shallow troughs are 1.21 DI at 500 fish per pound before the fish are transferred out to the raceways.

- Incubation, as with rearing, occurs in sediment free, 51-53 degree F (11 C) well water.

- Green egg to eyed-egg survival rates have improved. Mortality from green egg to eye-up has decreased from 25% to only 5%. .

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[67] *www.birdresearchnw.org. Dan Robie, OSU principal investigator.*

- After hatch and swim-up, the steelhead are introduced to feed, and transferred to 3 outside raceways at roughly 500 fish per pound in mid-May (approximately 65,000-70,000 fish per raceway). They are reared in these raceways until marking and all but 20,000 steelhead are transferred to Lake Three when they are between 40-50 fish per pound (August/early September). The 20,000 are held back to receive additional marks/tags, used for estimating total returns, before they are moved into lake 3 with the rest of the Wallowa stock.

- The flow in the raceways ranges from 500 to 1000 gallons per minute. Flow index in the raceways ranges from 0.03 at initial ponding (500 gpm) to 0.55 (1000 gpm) before the fish are transferred or released.

- Fry/fingerling are fed dry diet. Fry feeding starts at ~3 times daily (7 days per week) and is reduced to 1 times per day (weekdays only) as the fish increase in size. Range of feeding varies between 1.5 – 2.8% of fish body weight per day. Feed conversion is expected to fall in the range of 0.7:1.0 to 1.1:1.0 (dry feed) pounds fed to pounds produced. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance with program goals.

- Green to eye-egg survival for Wallowa stock steelhead is approximately 95%, eye-egg to fry 97-98%, and fry to smolt survival 80-85%.

- The maximum rearing density in the raceways is 0.02 DI at 4.5 fish per pound. The maximum rearing density in the lake is less than 0.002 lbs/ft3 at 4.5 fish per pound.

- Fish health checks occur at least monthly. Treatment for disease is provided by WDFW Fish Hatchery Specialists (hatchery staff) under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning once per week by brushing, and disinfecting equipment between raceways and/or between stocks on the hatchery site. Mortalities are removed from the raceways daily. The size and depth of the 2.1 acre lakes precludes cleaning other than yearly draining and drying during the summer when fish are removed. Water quality in the lakes is not affected due to low stocking density. Mortalities are rarely observed in the lakes.

- High densities during early rearing (when the steelhead are in the shallow troughs) may contribute to cold water disease later when the steelhead are reared in the raceways. Cold water disease is experienced periodically, resulting in minor loss of the Wallowa steelhead stock.

- When in the raceways, the juveniles receive medicated feed (florfenicol) when fish mortalities due to cold water disease reach over 100 per raceway per day. Through to 2007, fish were treated with "fish pills" coated with florfenicol to provide a 15 mg drug/kg fish weight treatment for 10 days. In the last two years, this treatment is given as florfenicol medicated feed at a lower dose of 10 mg/kg for 10 days, a less efficacious treatment. This is a 10 day treatment at 10mg/kg body weight per day.

- In late-August /early- September, Wallowa stock steelhead are adipose-fin clipped and transferred to Lake Three. 20,000 fish are held back to receive additional marks and tags. After three weeks, these 20,000 fish are transferred to Lake 3 with the rest of the Wallowa stock.

Release and Outmigration

- Wallowa steelhead are transferred to the Cottonwood Acclimation Facility at 6 fish per pound in February. Lake Three is drained at Lyons Ferry FH to retrieve the steelhead.

- The steelhead are acclimated, then released at 4.5fish per pound into the Grand Ronde River. After April 1 the acclimation pond's outlet screen is removed to allow the steelhead to outmigrate volitionally. The steelhead are allowed to outmigrate volitionally until May 1 at which time the pond is drained and the remaining fish are forced out. Feeding is reduced a couple of weeks before May 1 to encourage migration out of the pond.

- Length sampling occurs immediately prior to volitional release, before April 1. The average length of the steelhead are 205-210mm. NOAA Fisheries guidelines under the ESA require the release of summer steelhead at lengths ranging from 180 to 250 mm.. The coefficient of variation (CV) for the stock ranges from 11-13%.

Facilities and Operations

Lyons Ferry FH

See Lyons Ferry Fall Chinook section for Lyons Ferry FH Facilities and Operations

- Shallow troughs used for early rearing are 15'x'1 with .5' water depth. There are 11 batteries, each with 8 troughs. 2 batteries are used for egg isolation. All the troughs operate on a two-pass serial reuse system (the upper 4 of a battery receive fresh water and the lower 4 receive water from the upper 4).

- The raceways used for rearing steelhead are 10x88 with a 3.5' water depth. Flows are 500-1000 gpm.

- One of the three rearing lakes, Lake Three, is used for rearing Wallowa stock steelhead. The lake is 2.1-acres. The three large lakes receive 3,500 – 4,200 gpm total providing a good flow with no hydraulic problems.

Cottonwood Acclimation Facility

- Cottonwood Acclimation Facility has a water right of 2,694 gpm (6 cfs) for the period January 1st through July 1st. It is supplied with water from Cottonwood Creek through a gravity water supply system, with the intake integrated into the adult trapping facility located ~ 0.10 miles above the pond. Water temperatures range from 34 to 52 F during operation of the facility.

- Although there has only been one occurrence (2005), low flows from Cottonwood Creek during dry years can lead to bacterial gill disease.

- The intake for Cottonwood Pond is located at the adult trapping facility in Cottonwood Creek.

- The small size of the adult trap limits management options for dealing with returns. Given the large number of steelhead that return, staff pass hatchery steelhead upstream in part to alleviate densities in the trap.

- The living quarters meets the Service's Region 1 safety standards.

- The intake screens are 1/8" and do not meet NOAA screening criteria (3/32").
- The facility has a low water alarm.
- Staff are on site 24/7 when steelhead are being acclimated and the adult trap is being operated.
- Although there is a perimeter fence for security, there is no bird wire or predation fencing. Bird and mammal predation is not significant at this facility.
- The Team was unable to determine if the Service is the owner of record for the water right(s) of this facility.
- Although this facility reports water flow in its Monthly Discharge Monitoring Reports as a requirement for its NPDES Permit, water diversions are not adequately measured and reported to meet Service standards for documenting beneficial use and state standards for annual reporting.

Research, Education, and Outreach

- 20,000 steelhead are coded-wire tagged and left-ventral clipped shortly after they are adipose-fin clipped. 6,000 of these steelhead are PIT tagged soon thereafter (2,000 of this 6,000 are for the ongoing comparative survival study for steelhead production above Lower Granite Dam). After three weeks, these 20,000 fish are transferred to Lake 3 with the rest of the Wallowa stock.
- Coded-wire tag recoveries in the Grande Ronde have generally been close to the 20% recommended sample rate (20% of the fish harvested, according to catch record cards). This is in large part a result of coordinated efforts with Oregon Department of Fish and Wildlife.
- An initiative is being developed among LSRCP comanagers to standardize monitoring and evaluation and create a standardized data management system for data entry and reporting.
- PIT tag recoveries occur at both downstream and upstream facilities and mainstem dams. This includes recoveries at the dams and at Cottonwood Ponds. There are no PIT tag arrays on the Grande Ronde River.
- Coded-wire tag data provides information regarding contribution to fisheries. PIT tag data provides juvenile and adult survival information through the Columbia River basin dams and can be used for in-season harvest adjustments based on adult detections at the dams.
- WDFW has a growing concern that due to the success of the program and the resultant cuts in production, the number of fish contributing to the broodstock of the Wallowa program has been limited. This has led to research into methods to increase the Wallowa stock's effective population size. Since 2006, a small-scale experiment has been conducted on the broodstock at Cottonwood Creek to examine the effects of partially spawning females, and then releasing them to continue spawning in the stream. Results from the past three years have been very encouraging, with additional information gained each year. In 2008, 13 treatment and 4 control redds were covered and 11 treatment and 2 control redds were excavated at a later date. High stream flows or lost flags prevented the excavation of all marked redds. Preliminary results show that 91% of the study fish redds examined had growing embryos, and both of the control redd eggs were developing. High stream flows and turbid waters hampered the collection of more samples, and more conclusive results, hence the desire to repeat the experiment for one more year. For better control of the fish in the stream, there is a proposal to only release experiment fish upstream to spawn. This will

make locating and marking redds from study fish considerably easier on survey crews. This spawning strategy should increase and maintain a healthy effective population size for the Wallowa stock program, and gain some valuable insights into the spawning success of females after being partially spawned artificially. If documented as successful, this could become a valuable tool for the endemic programs in the Tucannon and Touchet Rivers where founding population size for each of these programs is low, and could be increased to more desirable levels. This spawning study will conclude in 2009.

- An initiative is being developed among LSRCP comanagers to standardize monitoring and evaluation and create a standardized data management system for data entry and reporting.

- Approximately 20 tourists visit the Cottonwood Acclimation Facility annually.

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[68] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- Annual estimated harvest (expanded from coded-wire tag recoveries) of Wallowa stock steelhead, released at Cottonwood facility in the lower Grande Ronde River, within the project area for broodyears 1997-2003 averaged 2,968 (range 1,209 to 5,341).

- Estimated harvest (expanded from coded-wire tag recoveries) within the project area of Wallowa stock steelhead, released at Cottonwood facility in the lower Grande Ronde River, accounted for 86.5% of the total estimated harvest on the stock (13.5% below the project area).

Conservation Benefits

- None identified.

Research, Education, Outreach, and Cultural Benefits

- Ongoing hatchery evaluation of rearing protocols, disease histories, feed conversion, and growth and survival rates are used in adaptive management feedback loops to improve hatchery operations. The information is also communicated to the fisheries community and greater public through scientific and management forums.

- Lyons Ferry FH staff cosponsor fishing derbies and provide educational opportunities to school groups and other visitors.

- The partial spawning and release experiment contributes to research regarding maintaining effective population sizes for the Wallowa program.

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[68] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[69] the Review Team identified the following benefits of this program:

Harvest Benefits

- The Wallowa steelhead program contributes to sport and tribal harvest downstream of the Snake River project area.

- Annual estimated harvest (expanded from coded-wire tag recoveries) of Wallowa stock steelhead, released at Cottonwood facility in the lower Grande Ronde River, below the project area for broodyears 1997-2003 averaged 479 (range 196 to 1,054).

- Estimated harvest (expanded from coded-wire tag recoveries) below the project area of Wallowa stock steelhead, released at Cottonwood facility in the lower Grande Ronde River, accounted for 13.5% of the total estimated harvest on the stock (86.5% below the project area).

- Estimated harvest (expanded from coded-wire tag recoveries) of Wallowa stock steelhead, released at Cottonwood facility in the lower Grande Ronde River, below the project area occurred in the ocean (0.0004%) net (4.1%) and sport (9.4%) fisheries. .

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Tribal harvest provides subsistence and cultural benefits to the Columbia River tribes.

- The partial spawning and release experiment contributes to research regarding maintaining effective population sizes for small hatchery programs.

- Hatchery staff provide educational opportunities offsite to other communities.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[70] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- The effective number of breeders is comparatively small to sustain the program over the long term.

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[69] *Ibid.*
[70] *Ibid.*

Demographic Risks

- High holding densities combined with the small size of the adult trap on Cottonwood Creek may increase stress and pose fish health risks and mortality to the adult steelhead or their progeny.

- Inadequate predation control at the Cottonwood Acclimation Facility may increase the potential for disease transmission from outside sources into the rearing pond and predation associated mortality.

- High densities during early rearing (when the steelhead are in the shallow troughs) may contribute to cold water disease later when the steelhead are reared in the raceways.

- Lack of shade covers over the raceways concentrates fish in shaded areas along raceway walls during summer months, increasing effective densities, potential stress, and disease risks. This is not applicable to rearing steelhead in

- Crowding and loading of fish onto trucks for transportation to release sites poses risks that do not occur with on-station releases. This extra handling associated with transportation may physically harm the fish, which may be contributing to increased post-release mortality.

- Transportation to release sites poses a demographic risk to the stock during transport and unknown physiological (stress) risks during transport and following release.

- The four Columbia River and four Snake River dams significantly reduce the survival of outmigrating juveniles and returning adults, posing a demographic risk to the return of sufficient numbers of adults for harvest on a consistent basis.

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in raceways that are over loaded. .

Ecological Risks

- Anadromous fish passage, especially steelhead, a species that has a higher prevalence of the IHN virus, pose a fish health risk to the adult steelhead held in the trap on Cottonwood Creek and the juveniles acclimated in Cottonwood Pond.

- Amplification of disease within the Lyons Ferry FH poses a disease risk to the propagated stock.

Physical Risks

- See the Lyons Ferry fall Chinook section.

- There is no hand railing on the downstream side of the adult trap, posing a human safety risk.

- There is no fence to prevent unauthorized access to the adult trap, posing a human safety risk and risk of catastrophic fish loss.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[71] the Review Team identified the following risks from the hatchery program:

Genetic Risks

- Outplanting Wallowa stock steelhead into the Lower Grande Ronde River poses genetic risks to the natural-origin Grande Ronde River steelhead populations. Nearby Joseph Creek and the Wenaha River are of special concern because they are managed as wild fish areas with no hatchery supplementation.

- Wallowa steelhead released in the Grande Ronde River are recovered in areas outside the Grande Ronde River basin, including the upper reaches of the Deschutes and John Day rivers. These strays pose a genetic risk to other steelhead stocks in the Columbia River basin.

- Allowing large numbers of adult hatchery steelhead passage above the weir in Cottonwood Creek poses genetic risks to the unmarked, naturally produced steelhead returning to spawn in the Creek.

Demographic Risks

- Harvest targeting Wallowa stock steelhead poses a demographic and genetic risk to natural-origin steelhead and local populations of redband rainbow trout in the Grande Ronde River.

- Harvest targeting Wallowa stock steelhead poses a demographic risk to bull trout.

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in raceways that are over loaded. .

Ecological Risks

- The transfer and release of Wallowa stock steelhead pose inherent ecological risks (e.g. competition, predation, disease) to natural-origin steelhead and local populations of redband rainbow trout in the basin in which they are released. Nearby Joseph Creek and the Wenaha River are of special concern because they are managed as wild fish areas with no hatchery supplementation. This risk is reduced by acclimating and releasing full-term smolts from a location with an adult recapture facility.

- Since steelhead are more likely to residualize than hatchery-reared salmon stocks, ecological risks are increased.

- Steelhead that residualize pose ecological risks to other species.

- Allowing large numbers of adult hatchery steelhead passage above the weir in Cottonwood Creek poses fish health and competition risks to the unmarked, naturally produced steelhead returning to spawn in the Creek.

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[71] *Ibid.*

- Allowing large numbers of steelhead passage above the weir in Cottonwood Creek may result in an organic overload compared to what the small creek system is capable of handling and could result in substantial changes to the natural ecology of the creek.

- The collection and barging of steelhead smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program[72]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue CC-SS1: Based upon the history of the Wallowa stock steelhead program, harvest downstream of the project area is much lower than the assumptions used to establish harvest goals. *Current mitigation and, subsequently, harvest goals have been based upon the assumption that that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (presumed 1:1 catch ratio). Harvest data indicates that 85% as opposed to 33% of the returning Wallowa steelhead are harvested in the Snake River project area. The adult mitigation and harvest goal for Wallowa Stock steelhead from Cottonwood Pond into the Grande Ronde is 1,501 and the program is achieving 4,250, with over 2,000 unharvested steelhead returning to the adult trap on Cottonwood Creek.*

Recommendation CC-SS1: Restate the return goal for the number of harvestable Wallowa stock steelhead or reduce the size of the program so that it is consistent with current harvest goals and is consistent with current and anticipated harvest regimes. Restate program goals in management documents based upon current and anticipated returns and harvest. For example,

[72] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

based on a 1.85% smolt-to-adult survival, to achieve a 1,501 adult return goal to the project area a release of 81,000 smolts would be required.

Issue CC-SS2a: Hatchery fish are passed above the adult trap on Cottonwood Creek with no clear objectives for hatchery and natural spawning other than to prevent straying to other tributaries in the Lower Grande Ronde River*. There appears to be no clear harvest, subsistence, or natural production benefits associated with additional hatchery fish in Cottonwood Creek. The natural spawning of Wallowa stock steelhead in the Lower Grande Ronde River also may not be consistent with Endangered Species Act and recovery of Snake River steelhead.*

Issue CC-SS2b*: **Anadromous fish passed above the trap in Cottonwood Creek can be infected with the IHN virus, serving as a potential source of infection to the adults held in the trap, and the juveniles reared in the acclimation pond (the intake for the acclimation pond is located at the adult trap**). This potentially amplifies virus within the population, affecting future generations of the stock. In 2009, WDFW genotyped the virus strain infecting the Cottonwood steelhead adults to better ascertain management needs.*

Recommendation CC-SS2a: Define the desired benefits for passing steelhead upstream of the adult trap in Cottonwood Creek (e.g. natural spawning, benefits to ecosystem function, research) relative to the risks (disease transmission such as the IHN virus). If the benefits of passing steelhead upstream do not outweigh the risks, then discontinue passing the steelhead upstream of the trap and identify other beneficial uses for surplus hatchery fish. If it is determined that there is a benefit to passing steelhead upstream, then the number of fish passed up stream should be consistent with the capacity of the habitat and for the purpose that the fish are being passed upstream. If fish are passed upstream, a monitoring and evaluation program should be instituted.

WDFW may consider reducing the size of the program to reduce the number of fish returning to Cottonwood Creek. The Team agrees that removing Wallowa stock steelhead from the Grande Ronde River to reduce potential straying and risks to natural populations (Wenaha River and Joseph Creek) is the correct management strategy.

The Service and WDFW should also determine whether purposefully allowing Wallowa stock steelhead to spawn naturally is consistent with the Endangered Species Act and recovery of Snake River populations.

Recommendation CC-SS2b: Use IHNV genotyping to allow management decisions to occur in a timely manner and to prevent the spread of a new variant of IHNV, particularly to the juveniles in the acclimation pond. The finding of a new virus variant of concern should be communicated to all fishery co-managers and aquaculture facilities (commercial, private, federal and state) so that appropriate biosecurity measures can be taken. A study of the IHNV prevalence in the adults transferred to Lyons Ferry FH should be conducted.

Recommendation CC-SS2c: For monitoring purposes, sample the steelhead juveniles for IHNV and other pathogens of interest 2 – 4 weeks prior to release from acclimation pond. The minimum number of fish sampled should provide 95% confidence level to detect the pathogen if present in the population at a 5% prevalence of infection (i.e., 60 fish sample).

Broodstock Choice and Collection

None identified.

Hatchery and Natural Spawning, Adult Returns

Issue CC-SS3: The genetic effective number of breeders per year is minimal with respect to genetic guidelines. *The number of males and females spawned per year utilizing a 1:1 female:male spawning ratio most likely results in an effective population size that is less than 300 fish over one steelhead generation (three years). The effective population size for the hatchery broodstock over three years should be greater than 500 fish (Ne > 500) to minimize the loss of genetic variation due to small effective population size and genetic drift.*

Recommendation CC-SS3: Increase the minimum number of females and males spawned per year to 75 females and 150 males, respectively. Subdivide the eggs of each female in approximately equal proportions and fertilize each subgroup separately with a different male. The two egg subgroups from each female can be combined ***after one minute*** before water is added to increase overall fertilization rates to compensate for males with poor sperm potency. Any culling of surplus eggs should be done randomly across all full-sib families with the goal of obtaining approximately equal numbers of fertilized eggs from each female and male parent.

Issue CC-SS4: The continued release of an out-of-basin stock into the Lower Grande Ronde River poses genetic and ecological risks to the natural-origin steelhead populations in the Grande Ronde River basin. *Of special concern are Joseph Creek and Wenaha populations, which are managed for natural production only. The proportion of hatchery-origin Wallowa stock adults escaping to natural spawning grounds is unknown.*

Recommendation CC-SS4: Monitor the natural escapement to ensure that less than 5% of the naturally spawning population are hatchery-origin Wallowa stock. This includes monitoring the selective fishery in the lower Wenaha to estimate the proportion of natural versus hatchery-origin steelhead. If it is determined that the proportion of hatchery fish spawning naturally is greater than 5%, consider reducing the program or converting to an in-basin broodstock. (This may include increasing the number of fish tagged to determine if Wallowa stock steelhead released from Cottonwood Ponds versus Wallowa Hatchery are straying to the spawning grounds. This may also require additional weirs for monitoring on selected streams.)

Issue CC-SS5: Wallowa steelhead released in the Grande Ronde River stray into areas of the lower Columbia River basin, including the upper reaches of the Deschutes and John Day rivers. *These strays pose a genetic risk to other steelhead stocks in the Columbia River basin.*

Recommendation CC-SS5: Continue to monitor the stray rate of the Wallowa stock. Also continue researching broodstock management (e.g. utilizing early versus late returns) and rearing and release strategies. Consider reductions in releases or evaluate alternate broodstock sources if straying remains an issue (see Alternative 2).

Incubation and Rearing

Issue CC-SS6: All steelhead female broodstock are tested for IHNV. The progeny from the females with virus titers of <10^4 pfu/ml (in the ovarian fluid) are kept for rearing. Management practices have improved adult returns so there is less need to keep excess progeny that may be infected with IHNV.

Recommendation CC-SS6: Cull progeny from all females that are positive for IHNV.

Issue CC-SS7a: Rearing densities in the indoor nursery tanks "shallow troughs" (1.15 max DI) exceed culture guidelines for steelhead, thus increasing fish health risks. *Due to space limitations in the intermediate and outdoor raceways, steelhead are held in the troughs beyond recommended rearing densities for steelhead. This protocol results in density indexes attaining D.I. = 1.21 in the indoor nursery tanks prior to transfer to the outdoor raceways.*

Issue CC-SS7b: High rearing densities during early rearing may be contributing to the later onset of cold water disease.

Recommendation CC-SS7: Reduce rearing densities in the shallow troughs to a maximum of D.I. = 0.5 by increasing the number of nursery rearing or intermediate rearing tanks (see LF-SS12), by reducing the total number of Lyons Ferry steelhead reared, by reducing the number of fish reared in other programs, or by reducing the total number of stocks reared at Lyons Ferry FH.

Issue CC-SS8: Delayed treatment of cold water disease may make it difficult to control mortality associated with the progression of the disease. *Cold water disease causes 3.5-5% mortality in the Lyons Ferry stock steelhead annually. When fish mortalities reach about 100 per raceway per day, they are treated with medicated feed (florfenicol). Formerly, fish were fed pills coated with 15 mg drug/kg of fish weight as prescribed by a veterinarian. New regulations now require the use of florfenicol medicated feed at 10 mg drug/kg fish weight with a Veterinary Feed Directive. The medicated feed is less effective in controlling disease and delivery time from the feed company is slow, resulting in less efficacious treatment.*

Recommendation CC-SS8: Test the therapeutic value of early fluorfenicol treatment by comparing treated and untreated fry in the shallow troughs (i.e., before coldwater mortality starts). In conjunction with this, test new diagnostic methods (e.g., PCR, QPCR) and/or culturing alternate tissues (such as brain) for earlier detection of cold water disease to ascertain if medication is warranted prior to ponding into the raceways. Also consider investigating different densities (1.21, 0.5, and 0.2 DI) of fry in the troughs to determine whether early rearing densities influence the development of coldwater disease. Continue working with the Bacterial Coldwater Disease Research Group, as supported by the Pacific Northwest Fish Health Protection Committee, to develop fish culture practices and treatment options to control or eliminate coldwater disease.

Release and Outmigration

Issue CC-SS9: *Pre-release exams which include testing for virus, bacteria and parasites are not done at the Lyons Ferry FH Complex and associated acclimation sites. There is a potential risk that endemic or vertically transmitted diseases might be undetected in released juveniles. This could affect their future survival and/or infected fish could serve as vectors in infecting other aquatic animals. Pre-release inspections, done 4-6 weeks before release or transfer are*

required by USFWS fish health policy FW 713 713 and the Integrated Hatchery Operations Team (IHOT) Policy and Procedures.

Recommendation CC-SS9: Sample 60 fish for pre-release inspections to meet the American Fisheries Society – Fish Health Section Blue Book requirements to ensure a 95% confidence in detecting pathogens at the minimum assumed pathogen prevalence level of 5%. Additional testing for non-reportable pathogens, such as *Flavobacterium psychrophilum* and *Nucleospora salmonis*, may be informative for co-managers.

***Issue CC-SS10**: **Anadromous fish passed above the trap in Cottonwood Creek can be infected with the IHN virus, serving as a potential source of infection to the adults held in the trap and to the juveniles reared in the acclimation pond (the intake for the acclimation pond is located at the adult trap)**.*

Recommendation CC-SS10: Sample the steelhead juveniles for IHNV and other pathogens of interest 2 – 4 weeks prior to release from acclimation pond. The minimum number of fish sampled should provide 95% confidence level to detect the pathogen if present in the population at a 5% prevalence of infection (i.e., 60 fish sample). If IHNV is found, genotyping should be done.

Facilities/Operations

Lyons Ferry FH

(See the Lyons Ferry FH Steelhead and Fall Chinook sections for facility issues and recommendations)

Cottonwood Acclimation Facility

Issue CC-SS11: The adult trap on Cottonwood Creek has no hand railing on the downstream side of the trap, posing a safety risk to staff and visitors.

Recommendation CC-SS11: Insert a hand railing that can be removed to provide access to the trap as needed.

***Issue CC-SS12: High holding densities combined with the small size of the adult trap on Cottonwood Creek may increase stress and pose fish health risks and mortality to the adult steelhead or their progeny.** The size of the adult trap is insufficient to accommodate the current run size and satisfy current management strategies. Currently, over 2,000 Wallowa stock steelhead return to Cottonwood Creek annually. Management practices are to collect steelhead at the trap and either hold them for broodstock or pass them upstream.*

Recommendation CC-SS12: Consult with engineering to redesign the trap to meet the program needs.

***Issue CC-SS13: Security for the adult trap is limited.** Currently, there is no fence to prevent unauthorized access to the trap. This poses human safety risks to the general public and increases the potential for catastrophic fish loss due to poaching or vandalism.*

Recommendation CC-SS13: Consult with engineering to construct a security fence.

Issue CC-SS14: The water intake screen for the Cottonwood Acclimation Facility does not comply with current NOAA Fisheries ESA screening criteria. The screen mesh is 1/8"; however, NOAA requires 3/32" mesh. NOAA criteria also include parameters for water approach velocity, sweeping velocity, and screen angle.

Recommendation CC-SS14: Replace the water intake screen for the Cottonwood Acclimation Facility so that it complies with NOAA Fisheries criteria. This may require modifications such as revolving drum screens to prevent debris accumulation that could obstruct the water supply.

Issue CC-SS15: The Lower Snake River Compensation Plan office is reviewing the ownership status of water rights associated with all the facilities which divert water for fish production that are operated by the comanagers. *Although ownership of several of the facilities has been transferred to the Service, the appropriate documentation to transfer the water rights may not have been filed in the respective state agency which administers water rights. Moreover, facility staff may not consistently or adequately record water use to ensure documentation of beneficial use in support of its water right(s) and as required by state law . Adequate documentation and reporting are required to maintain the right to divert water.*

Recommendation CC-SS15: Work with the Lower Snake River Compensation Plan office to ensure water diverted to Cottonwood Acclimation Pond for fish production is measured and reported correctly and the information is maintained by the Service's, Region 1 Engineering, Division of Water Resources.

Research, Monitoring, and Accountability

See CC-SS4 and 5 above. Also see issue and recommendation LF-FC24, 25, and 26 in the Lyons Ferry Fall Chinook section above.

Education and Outreach

See the Lyons Ferry Fall Chinook section for Education and Outreach issues and recommendations regarding Lyons Ferry FH.

Alternatives to Current Program

The Review Team considered the benefits and risks of the existing Cottonwood Creek hatchery steelhead program at Lyons Ferry FH and developed seven alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

Alternative 1: Current program with recommendations

Continue the current Cottonwood Creek hatchery steelhead program with implementation of all recommendations. These recommendations include: reviewing and restating the goals of the program and making adjustments in program size or stock as necessary; removing excess adult returns to the Cottonwood Creek facility; reviewing operations and facilities to improve fish health; developing spawning protocols that maintain an adequate effective breeding population size; and continuing to monitor straying of the Wallowa stock and seek to reduce strays into tributaries in the mid-Columbia DPS.

Pros

- Maintains mitigation harvest opportunities on Wallowa stock steelhead in the lower Grande Ronde and Snake rivers.
- Contributes to sport and tribal harvest downstream of the Snake River project area.

Cons

- Contributes to straying in the Deschutes and John Day river basins.
- The small number of fish used for broodstock may create a genetic "bottleneck".
- Large numbers of adult Wallowa stock steelhead returning to the Lower Grande Ronde River pose genetic risks to the natural-origin Grande Ronde River Basin steelhead populations.

Alternative 2: Replace the segregated Cottonwood Creek hatchery steelhead program with an endemic Lower Grande Ronde River stock program (e.g. Joseph Creek)

The intent of this alternative is to move away from releasing an out-of-basin composite stock into the Lower Grande Ronde River while continuing to return enough adults to satisfy the harvest/mitigation goals. If both the Oregon (Wallowa FH) and Washington (Cottonwood) programs transitioned from the Wallowa stock to a single, in-basin stock, then risks associated with utilizing an out-of-basin stock could be further reduced and there could be potential for either managing the broodstock at one single location.

Pros

- May reduce straying to natural populations in the upper Deschutes and John Day rivers.
- Reduces genetic risks associated with use of Wallowa stocks on natural populations in the Grande Ronde River.

Cons

- If the program is managed as integrated, this would likely require major infrastructure in Joseph Creek and/or other tributaries to accomplish this alternative.
- Managing the program as segregated may pose genetic risks to the natural populations in the Grande Ronde River.

- May reduce harvest opportunity in a large portion of the Grande Ronde River in Washington while an endemic stock is being developed.

- Poses a broodstock mining risk to a natural population that is potentially serving as a genetic reserve for the Grande Ronde Steelhead MPG.

Alternative 3: Increase the size of the Cottonwood Creek hatchery steelhead program to compensate for reductions or terminations of Lyons Ferry stock releases elsewhere

All of the releases associated with this alternative would occur at Cottonwood Creek. For example, replace the Lyons Ferry stock release in the Tucannon with increased Wallowa stock releases at Cottonwood.

Pros

- Could meet some of the lost mitigation harvest opportunities if Lyons Ferry stock was reduced or eliminated.

- Reduces the number of individual stocks reared at Lyons Ferry FH if releases of the Lyons Ferry stock are terminated.

- May simplify rearing pond/space management.

Cons

- Would result in additional adults back to the Cottonwood trap.

- Would increase the number of Wallowa stock steelhead straying into the upper Deschutes and John Day river basins, jeopardizing the recovery of the mid-Columbia River steelhead DPS.

- May increase genetic risks to natural populations in the Grande Ronde River.

Alternative 4: Rear Cottonwood Creek hatchery steelhead at Irrigon FH

Continue to collect adults and release juveniles at Cottonwood Acclimation Facility but transfer the rearing from Lyons Ferry FH to Irrigon FH.

Pros

- Frees up rearing space at Lyons Ferry FH. This enables reductions in rearing densities (esp. early rearing) for the other steelhead programs on station at Lyons Ferry FH.

- Maintains harvest opportunities in the Grande Ronde River.

Cons

- Requires considerable interstate comanager coordination.

- Requires either expansion of rearing space or reductions to other programs at Irrigon FH (e.g. Wallowa hatchery steelhead, Little Sheep Creek steelhead, resident trout, Chinook).

- May reduce steelhead harvest opportunities for both Washington and Oregon if other steelhead programs are reduced at Irrigon FH.

- Continues to contribute to or may increase the number of Wallowa stock steelhead straying into the upper Deschutes and John Day river basins, jeopardizing the recovery of the mid-Columbia River steelhead DPS.

Alternative 5: Discontinue the Cottonwood Creek hatchery steelhead program and increase the Wallowa hatchery steelhead program

Discontinue broodstock collection and release at Cottonwood Acclimation Pond and rearing at Lyons Ferry FH. Increase the ODFW-managed Wallowa hatchery steelhead LSRCP program that releases steelhead into the Grande Ronde Basin by approximately 100,000 to 160,000. This alternative may require expansion of Wallowa FH or Irrigon FH facilities to accommodate increased production.

Pros

- Frees up rearing space at Lyons Ferry FH. This enables reductions in rearing densities (esp. early rearing) for the other steelhead programs on station at Lyons Ferry FH.

- Maintains steelhead harvest opportunities in the Grande Ronde River.

- Reduces the number of steelhead stocks reared at Lyons Ferry FH, simplifying fish culture practices.

Cons

- Requires substantial infrastructure improvements at Wallowa FH if rearing were to occur there.

- Requires either expansion of rearing space or reductions to other programs at Irrigon FH (e.g. Wallowa hatchery steelhead, Little Sheep Creek steelhead, resident trout, Chinook).

- May displace the resident trout program if rearing were to occur at Wallowa FH.

- May reduce steelhead harvest opportunities for Washington due to the change in release locations (Wallowa FH versus Cottonwood Acclimation Pond) on the Grande Ronde River.

- May reduce steelhead harvest opportunities for both Washington and Oregon if other steelhead programs are reduced at Irrigon FH.

- Continues to contribute to or may increase the number of Wallowa stock steelhead straying into the upper Deschutes and John Day river basins, jeopardizing the recovery of the mid-Columbia River steelhead DPS.

- Increases the risk of disseminating whirling disease from the Wallowa FH acclimation pond to other steelhead populations. Of special concern are the natural populations in the upper Deschutes and John Day river basins.

Alternative 6: Terminate the program and decommission the Cottonwood Pond Acclimation Facility

Decommission hatchery in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site.

Pros

- Frees up rearing space at Lyons Ferry FH. This enables reductions in rearing densities (esp. early rearing) for the other steelhead programs on station.
- Reduces the number of steelhead stocks reared at Lyons Ferry FH, simplifying fish culture practices.

Cons

- Reduces steelhead harvest opportunities in the Grande Ronde River, especially in Washington.
- Eliminates a program with high smolt-to-adult survival.
- Reduces contribution of steelhead to ecological processes in Cottonwood Creek.

Recommended Alternatives

In reviewing the Cottonwood Pond steelhead program, team members had concerns related to the impacts of this program both in the lower Grande Ronde River and in downstream areas where hatchery fish from this program stray into natural spawning areas (Deschutes and John Day rivers). In spite of the relatively small size of the Cottonwood program, and fairly heavy harvest, large numbers of excess adult returns are passed up Cottonwood Creek or allowed to remain in the lower Grande Ronde River. The Wallowa stock released from Cottonwood pond has been identified as having a greater tendency to stray into downstream areas including the Deschutes and John Day rivers than other Snake River steelhead stocks. The Wallowa stock is a composite, hatchery-maintained stock derived from a mixture of steelhead trapped at the lower Snake River Dams and is not included in the threatened Snake River Steelhead DPS. Straying and spawning by Wallowa stock fish is considered to be a risk to other listed populations.

After reviewing alternatives, the Team recommended Alternative 1, maintaining the current program with recommendations.

Recommendations include:

- Review the goals of the program, restate the goals based on current knowledge and conditions, and make adjustments in program size or stock as necessary;
- Remove excess adult returns to the Cottonwood Creek Facility;
- Review operations and facilities to improve fish health and personnel safety concerns;
- Develop spawning protocols that maintain an adequate effective breeding population size. The team recognizes the quandary of potentially reducing the program size while maintaining an

effective breeding population larger than the current number of spawners is a quandary which may require changes in agency policy.

- Continue to monitor straying of the Wallowa stock and seek to reduce strays into tributaries in the mid-Columbia DPS. Measures to address the straying issue may include reductions in program size, and alternate broodstock such as the early-returning Wallowa stock being developed in Oregon.

The intent of this alternative is to develop specific management goals and objectives for achieving the harvest goals for Tribal and recreational fisheries and obtain the LSRCP mitigation goal of 1,501 adult steelhead back to the lower Grande Ronde River. At the same time, co-managers must address the causes of straying into downstream areas.

Some team members felt that development of an endemic stock (Alternative 2) should be evaluated as an attempt to improve returns and reduce straying concerns. However, this approach would require collecting broodstock from one or more of the listed natural populations of the lower Grande Ronde River to support a harvest mitigation program. This approach could result in a propagated stock with a small number of founding parents unless broodstock collection from the naturally produced population was ongoing, and uncertainty regarding the effectiveness of this concept to reduce straying and the potential to increase hatchery influence in local natural populations led the team to not support this option.

Alternatives 3 and 5 might exacerbate the concerns for Wallowa stock strays by increasing production and were not considered to be consistent with goals for recovery. Alternative 4 did not address the straying issues.

Two team members gave alternative 6 moderately high ratings because of the excess return and straying issues and the observation that large numbers of steelhead returning to the Wallowa programs in Oregon help support fisheries in the lower Grande Ronde River. However, the Team did not recommend Alternative 6, given the long-term needs to continue to meet the management intent of the states and tribes under the current *US v Oregon* agreement.

The chosen alternative, with recommendations, addresses the straying and excess adult issues by urging the co-managers to review and restate goals, making adjustments in program size or operation as more information comes available. WDFW should continue to evaluate the straying issue and participate with ODFW in research designed to control straying, including changing broodstocks or rearing protocols if indicated.

Touchet River Summer Steelhead

Operator: Washington Department of Fish and Wildlife

Summary of Current Program

Goals

- ***Harvest goal: :*** None. This is a research program to test the efficacy of developing an endemic broodstock program to replace the outplanting of Lyons Ferry steelhead in the Touchet River..

- ***Broodstock escapement goal:*** 16 natural-origin females and 20 natural-origin males.

- ***Conservation goal:*** None at this time. This is a research program. The long-term intent of this program is to reduce genetic and ecological risks to the natural population of steelhead in the Touchet River by replacing the outplanting of Lyons Ferry steelhead. Natural-origin steelhead in the Touchet River are included in the ESA listing of the *Mid-Columbia River Steelhead DPS* as a threatened species.

- ***Escapement goal for natural-origin adults: :*** None associated with the hatchery program. The ICTRT has established an interim annual abundance threshold of 1,000 natural-origin adults.

- ***Research, education, and outreach goals:*** Determine whether Touchet River steelhead can replace the Lyons Ferry stock as the broodstock used for all steelhead releases into the Touchet River.

Objectives

- Collect and spawn 16 natural-origin females and 20 natural-origin males to produce approximately 65,000 green eggs which results in approximately 50,000 yearling smolts for release in the Touchet River at RM 55 (Baileysburg Bridge). Pass all hatchery-origin steelhead from the endemic program upstream of the weir in the Touchet River to spawn naturally.

- Transfer adults retained for broodstock to Lyons Ferry FH. Adults are spawned at Lyons Ferry FH. Males are live spawned and returned to the Touchet River. Females are kill-spawned.

- Rear the resulting progeny to the smolt stage at Lyons Ferry FH. Develop and test culture protocols that result in one-year old smolts of the desired size and condition factor.

- Transfer and direct release 50,000 smolts upstream of the weir in the Touchet River.

- Use PIT tags and other tags to evaluate smolt-to-adult return rates back to Bonneville Dam, McNary Dam, and the Touchet River.

Program Description

From the inception of the LSRCP, releases of hatchery summer steelhead into the Touchet and Tucannon rivers have consisted of non-native origin steelhead (Wells, Wallowa, and Lyons Ferry hatchery stocks). While steady progress occurred toward meeting the LSRCP mitigation goal in both rivers, natural populations of steelhead throughout the Columbia and Snake river basins declined alarmingly, resulting in the implementation Endangered Species Act (ESA) protections by NOAA Fisheries in the late 1990s; including the Mid-Columbia River and Snake River summer steelhead *Distinct Population Segments* (DPS's). In 1999, NOAA Fisheries ruled that continued release of Lyons Ferry hatchery stock steelhead in the Touchet and Tucannon rivers jeopardized ESA listed natural populations of summer steelhead in those rivers. As a result of that ruling, an endemic broodstock program was initiated by WDFW and the co-managers to assess the feasibility of creating new broodstocks for use in the Touchet and Tucannon rivers (Bumgarner et al 2002). WDFW proposed that these new endemic stock programs - if proven successful - could be used in combination with, or eventually replace, the outplanting of Lyons Ferry summer steelhead in each river, thereby reducing risk to the natural populations in each ESU.

The two endemic stock programs began in 2000 under a 5-year study plan by trapping natural origin summer steelhead from each river for broodstock. These actions were approved through submission of Hatchery and Genetic Management Plans to NOAA Fisheries under the provisions of Section 4(d) of the ESA. Since that time, a relatively small proportion (N < 40 fish for each river) of the total number of natural origin fish returning to each river have been trapped, retained for broodstock, transported, and spawned at Lyons Ferry FH. Progeny have been reared at Lyons Ferry FH, and then released as smolts into the respective rivers from which their parents originated. Smolt to-adult return rates (SARs) from the first few years of the programs were not encouraging; although performance was based on very limited adult capture and/or tag data. WDFW and the co-managers agreed that additional years were needed to evaluate each program.

The goal of this program is to determine whether an endemic steelhead program can be developed that will yield sufficient numbers of returning adults to meet LSRCP mitigation, harvest, and conservation goals for steelhead in the Touchet River. If WDFW and comanagers conclude that an expanded endemic program would largely meet those desired benefits while reducing risks to the ESA listed natural population, then WDFW would most likely terminate the outplanting of Lyons Ferry steelhead for meeting LSRCP adult return goals for hatchery-origin steelhead in the Touchet River. The main purpose of an expanded endemic progam would be to meet the LSRCP mitigation and harvest goals for hatchery-origin steelhead in the Touchet River, as originally designed under the LSRCP program. Use of an endemic stock is intended to reduce genetic and ecological risks to natural populations while, at the same time, potentially serve a conservation role as needed or desired.

The Touchet River summer steelhead is considered an endemic program, meaning all fish released in the Touchet River can trace their ancestry to natural-origin adults trapped in the Touchet River. Adult steelhead are trapped in the Touchet River at the Dayton Pond AF intake structure and transferred to Lyons Ferry FH for holding and spawning. Their progeny are transported and released directly into the North Fork of the Touchet River as yearlings each spring. [Lyons Ferry FH Complex Annual Operations Plan 2008-2009, P 22]

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- Only natural-origin Touchet steelhead are collected and utilized for broodstock. All adult, hatchery-origin progeny of the hatchery program are passed upstream above Dayton trap to spawn naturally.

- Broodstock are collected from February through March at the Dayton trap on the Touchet River. This represents only the early part of the run. Natural returns occur from mid-February through mid-May. Broodstock are collected early to increase time at the hatchery in order to increase the potential for creating a one-year old smolt with the appropriate size at release.

- Touchet River steelhead, as part of the mid-Columbia ESU, are listed as threatened under the Endangered Species Act.

Hatchery and Natural Spawning, Adult Returns

- There is no harvest goal associate with the program at the present time. If successful, this programs primary purpose will be to provide harvest mitigation in the Touchet River as originally designed under the LSRCP program. There is potential for subsistence harvest in tribal fisheries on all steelhead in the Columbia and Snake river basins. However, there is currently no quantified "harvest" goal for this program.

- The long-term objective is to increase collection of endemic stock (hatchery and natural origin) adult steelhead as the naturally spawning population increases to reach a smolt release sizable enough to provide equal numbers of returns (750) as the Lyons Ferry stock steelhead to the project area. In this case, LSRCP adult mitigation return goals are equivalent to harvest goals. This LSRCP mitigation goal was based on the assumption that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (presumed 1:1 catch ratio).

- Current survival estimates indicate that 15 spawned females should provide enough eggs to meet the smolt production goal. Therefore, WDFW evaluation staff target collecting 16 natural-origin females and 20 natural-origin males for the broodstock, with all other natural-origin fish passed upstream to spawn naturally. Lyons Ferry stock hatchery steelhead are removed at the trap. Touchet endemic stock hatchery steelhead are passed above the trap to spawn naturally in the Touchet River.

- Tribal harvest of steelhead occurs in the lower Columbia River.

- The proportion of endemic hatchery-origin to natural-origin adult returns to the Dayton trap ranges from approximately 5-20%.

- Based on a combination of spawning ground surveys and weir counts, the estimated annual spawning escapement for the Touchet River is approximately 400-500 adult steelhead, with 5-20% being hatchery origin (half of the hatchery-origin are endemic Touchet hatchery stock half Lyons Ferry FH stock). The recovery goal is 1,000 naturally produced adults.

- Estimated smolt to adult (upstream of McNary Dam) survival rate of PIT tagged fish from the endemic hatchery program averaged 0.30 for years 2004-2006 smolt migration year (Table 2 of WDFW draft 2008 evaluation report).

- PIT tag data indicates that 50% of the hatchery-origin Touchet River stock detected at McNary Darm are straying up into the Snake River upstream of Ice Harbor Dam. It is unknown how many fall back below the dam or migrate into tributaries above the dam. These unmarked Touchet stock steelhead that pass above the dam are not subject to selective fisheries.

- Touchet and Tucannon summer steelhead have been documented in the area above Lower Granite Dam for years. However, the recent documentation of them entering and spawning in Asotin Creek, or other tributaries above Lower Granite Dam may be of concern. The endemic steelhead programs in the Touchet and Tucannon have been marked with PIT tags since 2001 (WDFW 2008 draft report on Touchet and Tucannon River summer steelhead).

- Spawning ground surveys occur in the Tucannon and Touchet River; however, conditions limit the information obtained.

- Weirs on the Tucannon and Touchet rivers are used to control upstream passage of Lyons Ferry stock hatchery steelhead. The goal is to only pass natural-origin and endemic program-origin steelhead above the weirs; however, stream conditions (high flows) allow for uncontrolled passage above the weirs. The Touchet River more often is not capable of controlling upstream passage compared to the Tucannon River. Recent modifications to the weirs (passage panels) may improve control of fish passage.

- Based on broodyear 2005, the smolt-to-adult return rate is approximately 0.5%. In previous years, the SARs were lower, likely affected by size and time at release. The steelhead are size graded as juveniles to allow compensatory growth of the slower growing fish. SARs are significantly lower for smaller-sized fish at release. The Touchet steelhead released at a smaller size have about a 0.2% SAR while the larger size are about 0.7%.

- From 2000-2007, on average 15 females (12-18) and 15 males (7-19) were spawned annually.

- Adult males are PIT tagged when they are collected to track the number of times they are used during spawning.

- Adults are transferred and held in an adult holding raceway at Lyons Ferry FH prior to spawning.

- Touchet and Tucannon stock are held in the same adult holding raceway, separated by a bar rack. Touchet are held downstream of the Tucannon stock due to the increased prevalence of IHNV in Touchet stock; however, the risk of IHNV or other pathogen infection across stocks, either way, exists. The adult holding pond is split because there is limited space for holding multiple stocks of adults at Lyons Ferry FH.

- Females are kill spawned and males are live spawned. Spawned males are transported and passed above the weir on the Touchet River. The males are held until all spawning is complete, then transferred back to the Touchet River and released above the weir.

- MS-222 is used to anesthetize adult steelhead when spawning.

- Spawning occurs from mid-March through mid-April on a weekly basis. Four to seven spawn takes occur over this time period.

- The steelhead are spawned performing a 2x2 factorial cross.

- WDFW follows the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Requirements include testing salmonid broodstock for regulated pathogens that are untreatable and that cause serious mortality (such as IHNV and other viruses. In steelhead broodstock, tests for reportable pathogens such as *R. salmoninarum*, other bacteria, and parasites (excluding *M. cerebralis*, a regulated pathogen) are not required by policy.

- All females are tested for viruses, including IHNV.

Incubation and Rearing

- Touchet stock steelhead average about 5,000 eggs per female.

- The eggs from Touchet female adults that are positive for IHNV are quarantined and, after hatch, are outplanted as buttoned-up, unfed fry at Baileysburg Bridge on the North Fork of the Touchet River (RM 55.2), or at the confluence of the South Fork/North Fork Touchet (RM 56). Outplanting button-up fry from IHN females is considered low risk because virus outbreaks in the juvenile progeny are rare (e.g. there hasn't been an IHN outbreak in the Lyons Ferry stock juveniles since 1992). This protocol is followed because the Touchet steelhead are a listed stock.

- Fertilized eggs are water hardened in 100-ppm iodophore. They are incubated until the eyed-egg stage in down-welling iso-incubation buckets (one female per bucket). Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus includes daily treatment with formalin (1:600). Non-viable eggs and sac-fry are removed by hand picking with egg pickers or bulb-syringe.

- After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs at 1 hatching basket per trough. Eggs from approximately 2 females are loaded in each basket (approx 10,000 eyed eggs). Eggs are inventoried and identified by female parent. Formalin treatment is discontinued once the eggs eye up and are transferred to the hatching baskets.

- 1 battery or 8 troughs are used for early incubation in the Touchet stock program. Flow is on average 8 gallons per minute (6-10 gallons per minute). Maximum rearing densities in the shallow troughs are .99 DI (at 700 fish per pound).

- During early rearing, feed rate and frequency is manipulated to accelerate the growth rate of late take progeny to achieve a mean size that is close to the mean size of early take progeny before they are transferred to the intermediate tanks.

- The steelhead are transferred to two indoor intermediate tanks (4x27x 2 feet in depth) in June. The flow for the intermediate tanks is 60 gpm. The maximum rearing density in the intermediate tanks is 0.33 DI (at 175 fish per pound)

- When the steelhead are moved outside, the coefficient of variation in the population increases to 12%.

- Fish rear in intermediate tanks until August or when fish reach 150-200 fish per pound, at which time they are transferred to 1, 10x88 outdoor raceway.

- The flow in the raceways ranges from 500 to 1000 gpm. Flow index in the raceways ranges from 0.03 at initial ponding (500 gpm) to 0.55 (1000 gpm) before the fish are transferred for release.

- The maximum rearing density in the raceways is 0.24 DI (at 4.5 fish per pound).

- In January, at 30-35 fish per pound, the steelhead are coded-wire tagged. After the steelhead are tagged, they are size graded and split into two 10x88 raceways, one containing the smaller sized group and the other, the larger sized group. The two groups then receive PIT tags proportionate to the number of steelhead in each size group.

- Due to the wild characteristics of the stock, shade covers, camouflage netting, and aquamats are used to mimic a more natural environment and prevent the steelhead from seeing staff feeding the fish. Lyons Ferry FH staff have found that Touchet stock steelhead don't feed well if they can see the person feeding.

- Fin erosion does occur in the Touchet stock while in the raceways (more so than the Lyons Ferry stock), even though they are at low rearing densities. This is most likely a result of the differences in stock (Touchet likely being more wild than Tucannon or Lyons Ferry) or in the rearing environment (higher densities in the raceways versus the Lyons Ferry stock, which are reared in Lake One).

- Fry/fingerling are fed dry diet. Fry feeding starts at ~3-8 times daily (7 days per week) and is reduced for larger sized group of fish once the fish are graded and into separate raceways. Range of feeding varies between 1.5 – 3.5% of the fishes' body weight per day. Feed conversion is expected to fall in the range of 0.8:1.0 to 1.5:1.0 (dry feed) pounds fed to pounds produced. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance with program goals.

- From 2000-20007, green egg to fry survival averaged 89% (47.7%-100%) with survival most often above 90%. Fry to smolt survival averaged 90% (70.4%-100.00%). In 2007, the high fry-smolt loss that resulted in 70.4% survival was due to stress induced mortality of 20,389 fish caused by overcrowding during the PIT tagging operation.

- Incubation, as with rearing, occurs in sediment free, 51-53 degree F (11 C) well water.

- Fish health checks occur at least monthly. Treatment for disease is provided by WDFW Fish Hatchery Specialists (hatchery staff) under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning once per week by brushing, and disinfecting equipment between raceways and/or between stocks on the hatchery site. Mortalities are removed from the raceways daily.

- Unlike the other steelhead stocks at Lyons Ferry FH, the Touchet stock experiences few problems with coldwater disease. These fish are reared at lower densities throughout rearing than the other stocks.

Release and Outmigration

- Most Touchet stock steelhead are released as yearling smolts, about 12 months after the parents were initially spawned. Beginning with BY2008, approximately 6,000 of the smaller-sized steelhead will be held until they are two-year-old smolts prior to release. See the research section below.

- All one-year-old steelhead smolts for the program are planned for a release size of 4.5 fish per pound.

- Length sampling occurs immediately prior to transfer and direct-stream release. The average length of the one-year-old release group steelhead reared is 205-210mm. NOAA Fisheries guidelines under the ESA require the release of summer steelhead at lengths ranging from 180 to 250 mm.. At release the coefficient of variation ranges from 13-18%.

- The steelhead are direct stream released into the Touchet River at Baileysburg Bridge (river mile 57.2), roughly 1.5 miles upstream from the Dayton Acclimation Facility. Direct-stream releases have occurred here each year to date. Release dates have varied from mid-April to early May based on stream flow conditions and expected size of fish at release.

- Between 2001 and 2008, the average release number was 48,450 (31,400 - 59,000).

- WDFW believes that many of the fish never migrate because of death immediately following release, residualism, or they were too small at release to leave the river and did not survive to the following spring (WDFW 2008 draft report on Touchet and Tucannon River summer steelhead).

- Minimum estimate of steelhead residualism for Touchet stock steelhead in the Touchet River from 2001 through 2005 averaged 2.8% (range 0.1%-4.7%).

- Large bird colonies on artificial islands located on artificial islands in Lake Wallula, near the mouths of the Snake and Walla Walla Rivers and in the downstream reservoirs and Columbia River Estuary consume significant numbers of steelhead, posing an ecological risk to Touchet stock steelhead. 23% of PIT tagged Snake River steelhead are reported to be consumed by avian predators in the estuary.[73]

Facilities and Operations

Dayton Acclimation Facility (Touchet River weir/intake diversion dam and adult trap)

- The Touchet River weir has limited control of upstream passage when the flows are high. In 2008, the weir was modified with plastic curtain to improve the control of upstream passage; however

[73] www.birdresearchnw.org. *Dan Robie, OSU principal investigator.*

the flaps only cover approximately 2/3 of the weir. In 2009, the plastic curtain was washed out during high flows.

- A trap has been operated at the Dayton Acclimation Facility since 2001. A new trap was installed in 2008 to improve adult collection.

- In 2009, WDFW plans to install a cover over the adult holding area to improve security and install an additional walkway at the intake diversion to improve safety during high flows.

Research, Education, and Outreach

- To estimate survival from smolt to adult and to identify the hatchery steelhead during broodstock collection and when managing upstream passage, all Touchet River endemic stock steelhead are coded-wire tagged with no external fin clips. 8,000-10,000 fish are PIT tagged to improve data gathering. The use of PIT tags is an alternate means to calculate smolt-to-adult survivals for program evaluation.

- Over the last few years, evaluation staff have annually PIT tagged portions of the Touchet River endemic stock group (by size) prior to release. PIT tags are being used to document smolt-to-adult survival rates. Results to date show that the group that is released per program goals and release time, have survived nearly twice the rate as those released later and sometimes at a smaller size. This, and trapping data, suggests this could be a continual problem in the Touchet River stock. Implementation of a two-year smolt program on a portion of the population to see if they can survive better is currently underway. These fish are reared in other rearing containers currently not being used for the other priority stocks at Lyons Ferry FH. This research will continue for 2-3 years, and will continue to PIT tag both one and two-year smolt programs for the comparison.

- An initiative is being developed among LSRCP comanagers to standardize monitoring and evaluation and create a standardized data management system for data entry and reporting.

- Lyons Ferry FH and Dayton Pond work to provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Lyons Ferry FH and LSRCP programs. The Dayton Lab monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex.

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[74] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- No direct harvest occurs on Touchet River hatchery-origin steelhead.
- Unmarked steelhead may contribute to the recreational fishery in the Touchet River as catch and release fish.

Conservation Benefits

- None identified or documented.

Research, Education, Outreach and Cultural Benefits

- The proram is providing valuable information on the difficulties of developing endemic hatchery programs for steelhead. This includes the development of culture protocols that increase survival and growth rates in captivity prior to smolting and release.
- The program evaluates over a five-year period whether a hatchery program utilizing endemic steelhead can be developed for long-term harvest benefits.
- Evaluates nontraditional steelhead rearing techniques (e.g. two-year-old smolt program) that may be necessary for endemic steelhead programs that use natural-origin adults for broodstock.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[75] the Review Team identified the following benefits of this program:

Harvest Benefits

- Touchet River stock steelhead may be harvested in non-selective fisheries downstream of the Touchet River, primarily in zone 6 tribal gillnet fisheries, between Bonneville and McNary dams. Coded-wire tag recoveries on non-adipose fin clipped fish are extremely limited.
- Unmarked steelhead may contribute to recreational fisheries downstream in the mainstem Columbia River as catch and release fish.

Conservation Benefits

- None identified.

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[74] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*
[75] *Ibid.*

Research, Education, Outreach and Cultural Benefits

- Contributes to the body of research regarding the development of endemic hatchery programs for harvest, regarding the use of nontraditional rearing techniques; and regarding the use of hatchery propagation for the restoration of wild steelhead populations.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[76] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- The comparatively small effective breeding number of the broodstock (mean N_b = 28) coupled with the deliberate upstream passage of endemic Touchet hatchery-origin adult steelhead poses a genetic risk to the natural population by potentially reducing the effective population size via genetic swamping of the natural population by hatchery-origin fish representing a small number of parents (*Ryman-Laikre Effect*).

- Utilizing only the early portion of the Touchet River run for broodstock, then allowing the hatchery progeny of those steelhead passage upstream to spawn naturally may, over the long term, impose artificial selection for earlier run timing in the natural population. This issue is correlated with the preceding issue.

- Limited control (at the weir) of upstream passage of adult hatchery-origin steelhead (both Touchet and Lyons Ferry stock) during high flows poses genetic and ecological risks to the natural-origin Touchet River steelhead population. However, these risks are considered less than those posed by Lyons Ferry steelhead.

- As a consequence of the two preceding risks, broodstock management practices coupled with upstream passage of hatchery fish for natural spawning are expected to reduce genetic variation in the natural population.

Demographic Risks

- Crowding, loading and transportation of adults at the Touchet River trap poses fish health risks and potential mortality to the adults and progeny.

- High densities during early rearing (when the steelhead are in the shallow troughs) increases fish health risks. .

- Crowding and loading of fish onto trucks for transportation to release sites poses risks that do not occur with on-station releases. This extra handling associated with transportation may physically harm the fish, which may be contributing to increased post-release mortality.

- Transportation to release sites poses a demographic risk to the stock during transport and unknown physiological (stress) risks during transport and following release.

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[76] *Ibid.*

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in raceways that are over loaded.

- The four Columbia River dams significantly reduce the survival of outmigrating juveniles and returning adults, posing a demographic risk to the return of sufficient numbers of adults for harvest on a consistent basis.

Ecological Risks

- Amplification of disease within the hatchery poses a disease risk to the propagated stock.

- Adult male steelhead held for broodstock and returned to the Touchet River may transmit diseases from Lyons Ferry FH to the natural population in the Touchet River.

- The release of fry that are progeny of IHN virus positive females may pose fish health risks to the Touchet River natural population, although the risk is considered low due to egg disinfection.

- Touchet stock steelhead are held in the same adult holding pond as Tucannon stock steelhead, posing a fish health risk to both stocks. Of special concern is the transmission of the IHN virus between stocks.

- Hatchery-origin steelhead that residualize pose ecological risks to the natural-origin Touchet River population.

Physical Risks

- See the Lyons Ferry fall Chinook section

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[77] the Review Team identified the following risks from the hatchery program:

Genetic Risks

- Spawning early returning steelhead may increase stray rates of progeny due to the amplification of an early return time of their progeny, when access to the Touchet River is limited (lower sections of the Walla Walla River may be impassable in August and September). This poses genetic and ecological risks to other steelhead stocks.

[77] *Ibid.*

- The practice of direct-stream releasing (outplanting) endemic stock Touchet River steelhead may increase their stray rates, posing genetic and ecological risks to other steelhead stocks.

- Touchet River stock steelhead that migrate above Ice Harbor Dam may not be able to fall back and return to the Touchet River. These steelhead above the dam may stray, posing genetic and ecological risks to other steelhead stocks.

Demographic Risks

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in raceways that are over loaded.

- Operation of a weir and adult trap for the Touchet River steelhead program poses risks of migration blockage, injury, and stress to other endemic fish species within the Tucannon Basin.

Ecological Risks

Also see the genetic risks section above.

- Rearing progeny of IHN virus positive females may pose fish health risks to other fish reared on station at Lyons Ferry FH; however, the risk is considered low due to egg disinfection and isolated rearing.

- Touchet steelhead are held in the same adult holding pond as Tucannon steelhead, posing a fish health risk to both stocks. Of special concern is the transmission of the IHN virus.

- Hatchery-origin steelhead that residualize may pose ecological risks to other species including bull trout.

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program[78]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

[78] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

Program goals and objectives

Issue TT-SS1: The Review Team understands that the short-term goal of the program is to "evaluate the capability of developing an endemic Touchet River hatchery stock that can replace the Lyons Ferry stock for meeting harvest mitigation goals while, at the same time, reducing genetic and demographic risks to the natural population of steelhead in the Touchet River*." The Team further understands that the purpose of the endemic broodstock program is NOT, at the present time, to restore or rebuild the naturally spawning population in the upper Touchet River via natural spawning supplementation by hatchery-origin fish. This latter goal could be a FUTURE purpose of the program but only if the CURRENT research goal of the program is first achieved and the capability to expand the program demonstrated. If this desired outcome is achieved, then the endemic program could be expanded with new long-term goals (e.g., harvest, conservation, or both) and new operational objectives for achieving them. The Team concluded that the current size and scope of the program are consistent with the research goal of the program but not with the goal of rebuilding a natural population via natural spawning supplementation by hatchery-origin fish (see Issues that follow). Management actions and operations inconsistent with the scope and goal of any hatchery program can pose significant risks to natural populations with little likelihood of achieving the intended benefits in most cases. Consequently, the deliberate passage of hatchery-origin fish upstream to spawn naturally and/or the direct release of hatchery-origin fry and smolts upstream of the weir would appear to directly conflict with the Team's understood purpose of the current program.*

Recommendation TT-SS1: Clearly define the specific goal and purpose of the current endemic broodstock program and restrict management actions to only those operations that directly support that specific goal**.** New goals can be established after the current short-term research goals are achieved.

Broodstock Choice and Collection

Issue TT-SS2: Utilizing only the early portion of the Touchet River run for broodstock, then allowing the hatchery progeny of those steelhead passage upstream to spawn naturally may, over the long term, impose artificial selection for earlier run timing in the natural population*. Touchet River steelhead return from late February through May; however, only adults trapped during February through mid-April are used for broodstock. Collecting only the early portion of the run is performed so that the progeny can be reared and released as one-year-old smolts.*

Recommendation TT-SS2: Collect steelhead for broodstock from the entire spectrum of the run and adjust culture protocols accordingly (see below).

Hatchery and Natural Spawning, Adult Returns

Issue TT-SS3. The genetic effective number of breeders for the broodstock is too low to support a natural spawning supplementation program under the current research goals of the program. *Hatchery-origin steelhead of the endemic Touchet River stock are passed upstream to spawn naturally in the Touchet River because NOAA Fisheries includes those fish with the ESA listed Snake River Summer Steelhead DPS. However, the deliberate release of those fish upstream to spawn naturally is not consistent with the research goals of the program. The deliberate release of hatchery-origin fish upstream also poses a genetic risk to the natural*

population because the mean effective number of breeders (parents) per year is only Ne = 28.3 adults, and hatchery-origin fish compose up to 20% of the naturally spawning population upstream of the weir.

Recommendation TT-SS3: Discontinue passing hatchery-origin steelhead upstream to spawn naturally. Increase the number of steelhead collected for broodstock to yield a minimum effective number of breeders each year of $N_b > 50$. This could be accomplished by spawning equal numbers of endemic hatchery and natural-origin fish pairwise within each of the 2x2 spawning matrices: HxW and WxH, respectively. This would yield a value of *pNOB* = 50%..

Issue TT-SS4: Spawning early returning steelhead may increase stray rates due to the amplification of an early return time of their progeny, when access to the Touchet River is limited (lower sections of the Walla Walla River may be impassable in August and September). *This poses genetic and ecological risks to other steelhead stocks*

Recommendation TT-SS4: Collect steelhead for broodstock from the entire spectrum of the run.

Issue TT-SS5a: Adult male steelhead held for broodstock and returned to the Touchet River may transmit diseases from Lyons Ferry FH to the natural population in the Touchet River*. Of special concern is the transmission of the IHN virus.*

Issue TT-SS5b: Adult male steelhead transported and utilized multiple times during spawning, then returned to the Touchet River experience excessive stress, increasing the potential for fish health issues. *Males returned to the Touchet River likely die shortly after release.*

Recommendation TT-SS5: Discontinue the return and release of adult male steelhead into the Touchet River.

Incubation and Rearing

Issue TT-SS6: Rearing densities in the indoor nursery tanks "shallow troughs" (1.15 max DI) exceed culture guidelines for steelhead, thus increasing fish health risks. *Due to space limitations in the intermediate and outdoor raceways, steelhead are held in the troughs beyond recommended rearing densities for steelhead. This protocol results in density indexes attaining D.I. = 1.15 in the indoor nursery tanks prior to transfer to the outdoor raceways.*

Recommendation TT-SS6: Reduce rearing densities in the shallow troughs to a maximum D.I. = 0.5 by increasing the number of nursery rearing or intermediate rearing tanks (see LF-SS12), by reducing the total number of Lyons Ferry steelhead reared, by reducing the number of fish reared in other programs, or by reducing the total number of stocks reared at Lyons Ferry FH.

Release and Outmigration

Issue TT-SS7: Outplanting fry that are progeny of IHN virus positive females may pose fish health risks to the Touchet River natural population. *Although the risk of the IHN virus being transferred to the progeny is considered low due to egg disinfection, the release of those fish still poses fish health risks to natural populations of steelhead populations compared to the*

expected very low if any benefits. Studies indicate that outplants at the subyearling fry stage have shown extremely low survivals to adulthood and may actually pose significant ecological risks by displacing natural-origin fry which are generally smaller at the time of outplanting. [79,80]

Recommendation TT-SS7: Discontinue outplanting fry. If the program size is increased, consider sampling the fry for viruses and retain and rear the group to smolt-stage only if they are IHN virus negative.

Issue TT-SS8: Pre-release exams which include testing for virus, bacteria and parasites are not done at the Lyons Ferry FH Complex and associated acclimation sites. *There is a potential risk that endemic or vertically transmitted diseases might be undetected in released juveniles. This could affect their future survival and/or infected fish could serve as vectors in infecting other aquatic animals. Pre-release inspections, done 4-6 weeks before release or transfer are required by USFWS fish health policy FW 713 713.*

Recommendation TT-SS8: Sample 60 fish for pre-release inspections to meet the American Fisheries Society – Fish Health Section Blue Book requirements to ensure a 95% confidence in detecting pathogens at the minimum assumed pathogen prevalence level of 5%. Additional testing for non-reportable pathogens, such as *Flavobacterium psychrophilum* and *Nucleospora salmonis*, may be informative for co-managers.

Issue TT-SS9: SAR's for progeny of larger-sized Touchet steelhead at release are higher than those for smaller sized (0.7% versus 0.2%). *Additionally, steelhead of smaller size at release may increase the potential for those steelhead to residualize. Current hatchery practices are to utilize only broodstock from the earlier portion of the run in order to increase size at release; however, this practice poses genetic and ecological risks (see recommendation TT-SS4).*

Recommendation TT-SS9: Continue to investigate the production of two-year-old smolts and/or the use of heated water to accelerate incubation growth rates for progeny of later-spawned individuals.

Facilities/Operations

Touchet River Trap

Issue TT-SS10a: Periodic high flows that occur when Touchet steelhead are returning may limit broodstock collection throughout the run. *Modifications to the Touchet weir have improved but not resolved trapping capabilitiesbut limitations remain.*

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[79] *Nickelson, T.E., M.F. Solazzi, and S.L. Johnson. 1986. Use of hatchery coho salmon (Oncorhynchus kisutch) to rebuild wild populations in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences 43: 2443-2449*
[80] *Kostow, K., A. Marshall, and S.R. Phelps. 2003. Natural Spawning Hatchery Steelhead Contribute to Smolt Production but Experience Low Reproductive Success. Transactions of the American Fisheries Society 132: 780-790.*

Issue TT-SS10b: Limited control of upstream passage of adult hatchery-origin steelhead (both Touchet and Lyons Ferry stock) during high flows poses genetic and ecological risks to the natural-origin Touchet River steelhead population.

Recommendation TT-SS10: Continue to work to modify the weir to improve trapping efficiency and control of upstream passage.

Lyons Ferry FH

See the Lyons Ferry FH Steelhead and Fall Chinook sections for additional facility issues and recommendations

Issue TT-SS11: Tucannon and Touchet steelhead stocks are held in the same adult holding pond at Lyons Ferry FH. *The two stocks are separated by a grated partition that splits the pond. Holding two stocks of steelhead in the same pond increases the potential for disease transmission between the stocks.*

Recommendation TT-SS11: Modify existing holding facilities or build new holding ponds so that the stocks can be held separately on first pass water.

Research, Monitoring, and Accountability

Issue TT-SS12: Touchet steelhead have a high degree of straying upstream of Ice Harbor dam. *Off-site releases (regardless as to whether they were acclimated or direct stream releases) of hatchery reared salmon and steelhead have consistently demonstrated reduced homing abilities in returning adults (Evenson 1992, Vander Haegen 1995, Johnson 1990). Current hatchery practices may be contributing to these stray rates, including the practice of rearing the fish to smolt stage at Lyons Ferry FH, then transporting them and direct-stream releasing them in the Touchet River. Facilities at mainstem dams to accommodate passage of migrating adults both upstream and downstream may also be inadequate.*

Recommendation TT-SS12a: Continue to investigate the degree of homing and straying and experiment with rearing and release strategies to reduce straying. Investigate the feasibility of building a small steelhead incubation and rearing facility (hatchery) on the Touchet River to increase homing and reduce straying.

Recommendation TT-SS12b: Continue to investigate safe passage of adult steelhead, both upstream and downstream of mainstem dams.

Issue TT-SS13: Releasing Touchet stock steelhead and Lyons Ferry steelhead in different manners complicates comparison of the performance of the two stocks. *The Lyons Ferry program may be benefiting from increased survival over the endemic Touchet stock due to larger size at release and acclimation prior to release.*

Recommendation TT-SS13: Evaluate rearing and release strategies to maximize the return of the endemic stock (e.g. acclimation, volitional release, size-at-release). If necessary, discontinue the use of the Dayton Pond AF for releasing Lyons Ferry steelhead and use the pond for acclimating Touchet River steelhead prior to release. Lyons Ferry steelhead can be directly released downstream from the Dayton Pond AF if those releases continue.

Issue TT-SS14: Current marking and tagging practices are suitable for achieving current program objectives. *Touchet stock are coded-wire tagged so that the hatchery fish can be distinguished from natural-origin fish when they return to the trap. 8,000-10,000 steelhead are PIT tagged to provide survival and stray data.*

Recommendation TT-SS14: Continue the current marking and tagging practices. Consider increasing the number of steelhead PIT tagged to 10,000-15,000 so that smolt-to-adult survival can be estimated, given that survival rates associated with this endemic program currently vary and are at times low.

Education and Outreach

See the Lyons Ferry Fall Chinook section for Education and Outreach issues and recommendations regarding Lyons Ferry FH.

Alternatives to Current Program

The Review Team considered the benefits and risks of the existing endemic Touchet River steelhead program at Lyons Ferry FH and developed five alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

Alternative 1: Current program with recommendations

Continue the current endemic summer steelhead program on the Touchet River with implementation of all recommendations. Clearly define the specific goal and purpose of the current endemic broodstock program and restrict management actions to only those operations that directly support that specific goal**.** The Review Team understands that the specific purpose of the program at the present time is research. Collect adult steelhead from throughout the natural run time and discontinue the deliberate passing hatchery-origin steelhead (including endemic Touchet hatchery fish) above the weir while continuing to pass upstream all natural origin steelhead not retained for broodstock. Continue to investigate the degree of homing and straying and experiment with rearing and release strategies to reduce straying..

Pros

- Responds to the need for continued research to work out culture protocols that will optimize smolt to adult return rates for progeny of natural-origin steelhead.

- As new culture protocols are developed, promotes development of a local broodstock to replace the Lyons Ferry stock in the Touchet River, potentially reducing genetic and ecological risks to the listed steelhead stock.

- A successful, endemic hatchery stock could serve as a potential genetic reserve for the listed Touchet River population, thereby reducing the demographic risks of extinction, contribute to the recovery of the *Mid-Columbia Steelhead DPS*, and assist with achieving conservation goals for the Touchet River population of steelhead, but only if the program is expanded for those specific purposes.

Cons

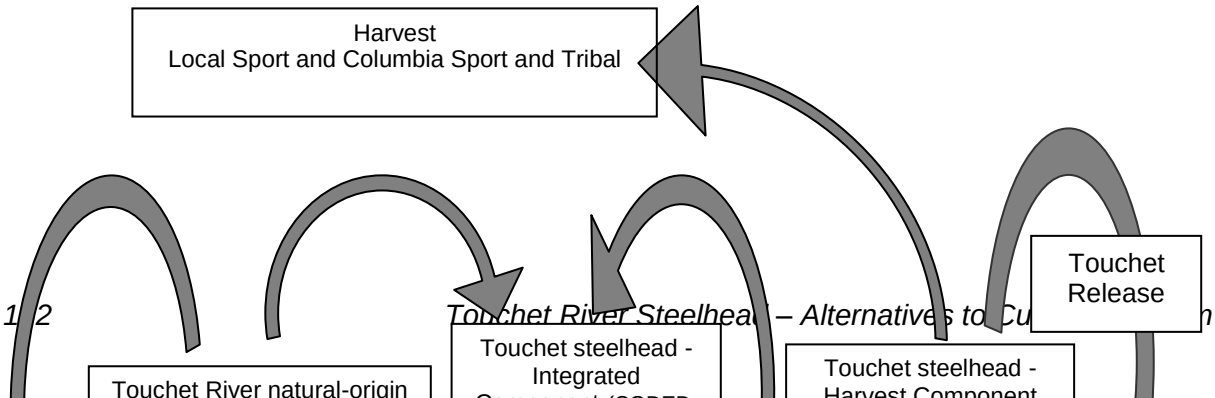
- Maintains the risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Touchet River.

- Reduces slightly the number of fish available for harvest by utilizing space at Lyons Ferry FH that could be used for harvest program fish (e.g. Lyons Ferry stock).

- Reduces the number of natural-origin steelhead spawning naturally above the Touchet River weir, particularly if trapping capability of the weir can continue to be improved.

Alternative 2: Expand the Touchet endemic steelhead program by creating a stepping-stone program for harvest and conservation

Utilize returning hatchery-origin endemic Touchet stock as broodstock and cross with natural-origin steelhead (HxW, WxH) from the Touchet trap to create a larger integrated broodstock with *pNOB* = 50%. Use hatchery-origin adults in surplus of broodstock needs as a "stepping stone" to form a second broodstock (HxH) for producing fish available for harvest. Such a two-stage, stepping-stone program would produce fish for harvest with potential conservation benefits. This could be accomplished at Lyons Ferry FH by differentially marking broodstock where the integrated conservation component would be coded-wire tag-only and the harvest component would be adipose-fin clip/coded-wire tag. Collect enough natural-origin adults to produce a PNOB of 0.5 and a PHOS as close to 0.0 as possible. As local broodstock collection ability increases over the long term, phase out Lyons Ferry stock steelhead and replace with the Touchet stock for harvest purposes.



Pros

- Contributes to sport and tribal fisheries in the Touchet, Walla Walla, and Columbia rivers.
- Promotes development of a local broodstock to replace Lyons Ferry stock in the Touchet River, potentially reducing genetic and ecological risks to the listed steelhead stock.
- Serves as a genetic reserve for the listed Touchet River population and a conservation program for the Touchet River population, above the weir.
- Reduces the demographic risk of extinction and potentially contributes to the recovery of the Mid-Columbia River steelhead DPS.

Cons

- Further complicates rearing at the Lyons Ferry FH that already has space limitations.
- Only serves as a conservation program for the component of the Touchet River population above the weir if the weir is fully functional.
- The risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Touchet River would still exist.
- Temporarily reduces the number of fish available for harvest by utilizing space at Lyons Ferry FH that could be used for harvest program fish (Lyons Ferry stock) until the Touchet population is large enough for harvest management.
- Reduces the number of natural-origin steelhead spawning naturally above the Touchet weir.
- Incidental take limitations of ESA-listed natural-origin Touchet River steelhead may limit harvest opportunity for hatchery-origin steelhead in the Touchet River.
- Could increase the number of steelhead that stray upstream of Ice Harbor Dam.

Alternative 3: Expand the Touchet endemic steelhead program by creating a segregated, for harvest program downstream of the weir and manage the population upstream of the weir for natural production only

Manage the hatchery program as a segregated program while passing only natural-origin adults upstream of the lower weir for conservation of the Touchet River stock. This alternative would require modifying the current weir so that it is more efficient at excluding upstream passage of hatchery-origin steelhead.

Pros

- Maintains current harvest benefits.
- Reduces or eliminates hatchery influence on the Touchet natural-origin steelhead population above the weir.
- Over the long-term, the program is not dependent on the natural population as a broodstock source, eliminating any take of natural-origin adults for broodstock.

Cons

- Cost associated with modifications to the weir to further exclude hatchery-origin steelhead from upstream passage.
- The weir would still have to be operated to preclude hatchery fish from migrating upstream.
- Maintains the risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Touchet River.
- Incidental take limitations of ESA-listed natural-origin Touchet River steelhead may limit harvest opportunity for hatchery-origin steelhead in the Touchet River.
- Could increase the number of steelhead that stray upstream of Ice Harbor Dam.

Alternative 4. Establish a rearing facility on the Touchet River (this alternative is tentative until further investigation by the Review Team)

Move production of the Touchet River steelhead program from Lyons Ferry FH to the Touchet River. This could begin as a temporary facility with potential for establishing a permanent rearing site if the current research program indicates that a Touchet River program can be developed that will meet comanager harvest and/or conservation goals.

Pros

- Reduces the number of stocks reared at Lyons Ferry FH.
- Eliminates the potential for transporting pathogens, including IHNV, from Lyons Ferry FH to the Touchet River.

- Frees up rearing space at Lyons Ferry FH and reduces potential costs associated with modifying the facility to properly accommodate the Touchet River steelhead program.

- May reduce straying of hatchery-origin Touchet River steelhead since they will no longer be reared at Lyons Ferry FH.

Cons

- Costs associated with infrastructure needs and supplemental water sources at the Dayton Ponds/Lab and the Touchet River Trap.

Alternative 5: Terminate the Touchet endemic steelhead program

Terminate the program in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site.

Pros

- Eliminates hatchery influence on the Touchet River natural-origin steelhead population above the weir if the weir is modified so that it is an effective exclusion mechanism or if the releases of Lyons Ferry steelhead are discontinued and straying of hatchery fish into the Touchet River is limited.

- Reduces the number of stocks reared at Lyons Ferry FH and increases the rearing space available for other Lyons Ferry FH programs.

Cons

- Continued cost associated with operating the weir to monitor the natural steelhead population and preclude hatchery-origin steelhead from migrating upstream.

- Reduces sport harvest opportunities in the Touchet and Walla Walla rivers.

- Concludes a research program to determine whether Lyons Ferry steelhead releases could be replaced by Touchet stock releases into the Touchet River before additional rearing and release modifications are made that could increase survival of the hatchery-origin Touchet stock.

Recommended Alternatives

The Team recommends Alternative 2: phase-out or terminate the release of Lyons Ferry hatchery steelhead in the Touchet River and expand the current integrated endemic program for steelhead to a two-stage, stepping-stone program. Alternative 2 is intended to be implemented consistent with all the recommendations in Alternative 1.

The intent of Alternative 2 is to address both conservation and harvest goals for steelhead in the Touchet River. The Review Team understands that the primary purpose of the current endemic program is "research" to determine the potential efficacy of developing a localized integrated hatchery program as an alternative to the continued outplanting of non-native Lyons Ferry steelhead. The Review Team concluded that adult return rates back to the Touchet River from the current endemic program were sufficient to expand the program for the immediate purpose of addressing conservation

needs for steelhead in the Touchet River, largely because hatchery-origin adults in excess potential broodstock needs are currently being trapped and passed upstream. A second broodstock could be developed, based on adult returns from the first broodstock, to support Tribal and recreational fisheries. However, continued improvements in smolt-to-adult return rates (SARs) for the endemic program in the Touchet River may be necessary before this latter second stage broodstock can be developed. Adult returns from both broodstocks would contribute to the overall LSRCP mitigation goal for steelhead in the Snake River, while fish from the second "segregated" broodstock would contribute exclusively to the mitigation goal of 750 hatchery-origin steelhead available for harvest in the Touchet River.

The size of the integrated conservation component of the program would be based annually on the returning natural population. The current endemic (*integrated*) program could be expanded to approximately 50 adults (25 females)—without increasing the number of natural-origin adults used for broodstock—by retaining equal numbers of F1 hatchery-origin and natural-origin adults and crossing the two groups of fish pairwise (♀-nat. x ♂-hat., and ♀-nat. x ♂-hat.) in each of the spawning matrices so that all progeny had at least one natural-origin parent. This spawning protocol would result in a value of *pNOB* = 50% for the first broodstock. Returning F1 hatchery-origin adults (tagged but not fin-clipped) surplus to the needs of the integrated broodstock would not be passed upstream but would be retained and spawned as a second broodstock to produce fish for harvest. These latter F2 hatchery-origin progeny would be given an adipose fin clip and - as returning adults - could be included in the second broodstock as needed by directly crossing them with returning adults resulting from the first broodstock (e.g., ♀-F1-hat. x ♂-F2-hat., and ♀-F2-hat. x ♂-F1-hat). This cross-breeding of natural-origin fish with F1 hatchery fish in the first broodstock, and F1 x F2 hatchery fish for the second broodstock would ensure (a) continuous gene flow from the natural population to the 2nd broodstock, thereby reducing genetic risks to the natural population, and (b) the absence of sibling matings. Surplus hatchery-origin adults produced from the first broodstock would, in general, not be passed upstream unless doing so was necessary to prevent extirpation or to maintain a viable natural population.

The number of adults spawned for the second broodstock would be based on the 750-adult mitigation goal and the expected or predicted smolt-to-adult return rates back to the Touchet River. For example, assuming a 0.30% smolt-to-adult return rate (SAR) back to the Touchet River (unpublished data, WDFW), approximately 250,000 smolts from the second broodstock would need to be released into the Touchet River to achieve the mitigation return goal of 750 adult steelhead, and approximately 80 females (160 adults total) would need to be retained for broodstock to produce 250,000 smolts. These latter broodstock and smolt release numbers may exceed culture facilities currently available at Lyons Ferry Hatchery and may create concerns regarding ecological (competition) risks to natural origin smolts in the Touchet River. Consequently, the Team recommends implementation of modified culture protocols that are expected to increase smolt-to-adult return rates from the current average of 0.30% (most recent estimated rates are approximately 0.5%), including the use of heated water during egg incubation or early rearing to increase mean size at release. As smolt-to-adult return rates increase and a second broodstock and the proposed "stepping stone" program develop, a greater proportion of the second broodstock could be composed of F1-hatchery fish from the first broodstock. No F2 hatchery-origin adults would be passed upstream to spawn naturally unless absolutely necessary as an emergency conservation measure.

Both components of the stepping stone program could be accomplished at Lyons Ferry Fish Hatchery by differentially marking broodstock where the integrated conservation component would be coded-wire tag-only and the harvest component would be 100% adipose-fin clipped with only a portion tagged for monitoring and evaluation purposes. The harvest component could be direct released while

the integrated component could be released from the acclimated pond if the pond was not of sufficient size to acclimate both groups of fish simultaneously.

The Team's recommendation is intended to meet near-term conservation goals for the Touchet River population, while developing a harvest component to meet harvest and fishery management goals in the area. The Team's recommended alternative is also meant to be consistent with the intent of the current *US v. Oregon* agreement and LSRCP mitigation obligations. The Team also felt that our recommended alternative would be consistent with any potential actions that may be taken in the future to address ICTRT recovery recommendations.

The Team recognizes that Alternative 2 will require a significant investment to expand or modify culture facilities at Lyons Ferry Hatchery to accelerate the growth of Touchet River steelhead or rear a portion of each brood year for two years to achieve the desired size at release. On the other hand, the Team's recommendation could be initiated at a smaller scale than currently required to meet the 750 adult-return mitigation goal for steelhead in the Touchet River.

If comanagers conclude that implementing Alternative 2 is premature at this time, then the Team recommends implementation of Alternative 1 and Alternative 4: continuation of the current research program with implementation of all program specific recommendations and potential development of a rearing facility on the Touchet River to improve SARs. Currently, Lyons Ferry steelhead are acclimated and released from the acclimation pond in Dayton and the endemic steelhead are direct released upstream of the weir. The Team believes that, as part of the continued research program, the release of Lyons Ferry steelhead in the Touchet River should be suspended and the acclimation pond used to acclimate steelhead smolts from the endemic program to determine if that simple change will result in an increase in SARs. The Teams recommendations also include termination of the passage of hatchery-origin adults upstream of the weir because doing so creates genetic risks and is superfluous to the research goal of the program. Instead, those hatchery-origin fish should be crossed with natural-origin adults to further test the efficacy of the current program.

The Team did not support development of a new, segregated hatchery program for steelhead in the Touchet River (Alternative 3), largely because it would inevitably create risks similar to the current program after many generations and would not – in the long term – provide conservation benefits for a natural population that may not be viable. The Team also believed that termination of the current endemic program (Alternative 5) was premature from a research perspective because many options for potentially improving SARs had not been tested.

Tucannon River Summer Steelhead

Operator: Washington Department of Fish and Wildlife

Summary of Current Program

Goals

- ***Harvest goal:*** None. This is a research program to test the efficacy of developing an endemic broodstock program to replace the outplanting of Lyons Ferry steelhead in the Tucannon River.

- ***Broodstock escapement goal:*** 15 natural-origin females and 21 natural-origin males.

- ***Conservation goal:*** None at this time. This is a research program. The long-term intent of this program is to reduce genetic and ecological risks to the natural population of steelhead in the Tucannon River by replacing the outplanting of Lyons Ferry steelhead. Natural-origin steelhead in the Tucannon River are included in the ESA listing of the *Mid-Columbia River Steelhead DPS* as a threatened species.

- ***Escapement goal for natural-origin adults:*** None associated with the hatchery program. The ICTRT has established an interim annual abundance threshold of 1,000 natural-origin adults.

- ***Research, education, and outreach goals:*** Determine whether Tucannon River steelhead can replace the Lyons Ferry stock as the broodstock used for all steelhead releases into the Tucannon River.

Objectives

- Collect and spawn 15 natural-origin females and 21 natural-origin males to produce approximately 65,000 green eggs which results in approximately 50,000 yearling smolts for release in the Tucannon River. Pass all hatchery-origin adult steelhead from the endemic program upstream of two collectin weirs in the Tucannon River to spawn naturally.

- Transfer adults retained for broodstock to Lyons Ferry FH. Adults are spawned at Lyons Ferry FH. Males are live spawned and returned to the Tucannon River. Females are kill-spawned.

- Rear the resulting progeny to the smolt stage at Lyons Ferry FH. Develop and test culture protocols that result in one-year old smolts of the desired size and condition factor.

- Transfer pre-smolts to Tucannon FH for acclimation for 1-2 months prior to release.

- Transport from Tucannon FH and direct release 50,000 smolts at RM 42 (Camp Wooton Bridge, one mile upstream of Curl Lake) in the Tucannon River.

- Use PIT tags and other tags to evaluate smolt-to-adult return rates back to Bonneville Dam, McNary Dam, and the Touchet River.

Program Description

From the inception of the LSRCP, releases of hatchery summer steelhead into the Touchet and Tucannon rivers have consisted of non-native origin steelhead (Wells, Wallowa, and Lyons Ferry hatchery stocks). While steady progress occurred toward meeting the LSRCP mitigation goal in both rivers, natural populations of steelhead throughout the Columbia and Snake river basins declined alarmingly, resulting in the implementation Endangered Species Act (ESA) protections by NOAA Fisheries in the late 1990s; including the Mid-Columbia River and Snake River summer steelhead *Distinct Population Segments* (DPS's). In 1999, NOAA Fisheries ruled that continued release of Lyons Ferry hatchery stock steelhead in the Touchet and Tucannon rivers jeopardized ESA listed natural populations of summer steelhead in those rivers. As a result of that ruling, an endemic broodstock program was initiated by WDFW and the co-managers to assess the feasibility of creating new broodstocks for use in the Touchet and Tucannon rivers (Bumgarner et al 2002). WDFW proposed that these new endemic stock programs - if proven successful - could be used in combination with, or eventually replace, the outplanting of Lyons Ferry summer steelhead in each river, thereby reducing risk to the natural populations in each ESU.

The two endemic stock programs began in 2000 under a 5-year study plan by trapping natural origin summer steelhead from each river for broodstock. These actions were approved through submission of Hatchery and Genetic Management Plans to NOAA Fisheries under the provisions of Section 4(d) of the ESA. Since that time, a relatively small proportion (N < 40 fish for each river) of the total number of natural origin fish returning to each river have been trapped, retained for broodstock, transported, and spawned at Lyons Ferry FH. Progeny have been reared at Lyons Ferry FH, and then released as smolts into the respective rivers from which their parents originated. Smolt to-adult return rates (SARs) from the first few years of the programs were not encouraging; although performance was based on very limited adult capture and/or tag data. WDFW and the co-managers agreed that additional years were needed to evaluate each program.

The goal of this program is to determine whether an endemic steelhead program can be developed that will yield sufficient numbers of returning adults to meet LSRCP mitigation, harvest, and conservation goals for steelhead in the Tucannon River. If WDFW and comanagers conclude that an expanded endemic program would largely meet those desired benefits while reducing risks to the ESA listed natural population, then WDFW would most likely terminate the outplanting of Lyons Ferry steelhead for meeting LSRCP adult return goals for hatchery-origin steelhead in the Tucannon River. The main purpose of an expanded endemic progam would be to meet the LSRCP mitigation and harvest goals for hatchery-origin steelhead in the Tucannon River, as originally designed under the LSRCP program. Use of an endemic stock is intended to reduce genetic and ecological risks to natural populations while, at the same time, potentially serve a conservation role as needed or desired.

The Tucannon River summer steelhead is considered an endemic program, meaning all fish released in the Tucannon River can trace their ancestry to natural-origin adults trapped in the Tucannon River. Adult steelhead are trapped in the Tucannon River at permanent weir at RM 35 and a temporary weir at RM 24 and transferred to Lyons Ferry FH for holding and spawning. Their progeny are transported to Tucannon FH for 1-2 months of acclimation and then released directly into the Tucannon River at RM 42 at the Camp Wooton Bridge..

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- There is no recreational harvest goal at this time. If successful, this programs primary purpose will be to provide harvest mitigation in the Tucannon River as originally designed under the LSRCP program. There is potential for subsistence harvest in tribal fisheries on all steelhead in the Columbia and Snake river basins. However, there is currently no quantified "harvest" goal for this program.

- The long-term objective is to increase collection of endemic stock (hatchery and natural origin) adult steelhead as the naturally spawning population increases to reach a smolt release sizable enough to provide equal numbers of returns (875) as the Lyons Ferry stock steelhead to the project area. In this case, LSRCP adult mitigation return goals are equivalent to harvest goals This LSRCP mitigation goal was based on the assumption that two-thirds of returning adults would be caught downstream of the project area (presumed 2:1 recreational-to-commercial catch ratio), while one third of the returning adults would be available for recreational and tribal/commercial fisheries within the project area (presumed 1:1 catch ratio)

- Current program goals can be reached by spawning 13 to 14 females. Additional males (over 14) will be collected or live spawned and released at the adult trap to ensure an adequate number of males are available. Therefore, WDFW evaluation staff target collecting 15 natural-origin females and 21 natural-origin males for broodstock from the Tucannon River, with all other natural origin fish passed upstream to spawn naturally. Hatchery fish (Lyons Ferry FH stock) collected at the trap are opercle punched and passed downstream to be recycled in the fishery. Hatchery fish (endemic origin) are passed above the trap to spawn naturally in the Tucannon River.

- The intent is to collect and utilize only natural-origin Tucannon steelhead for broodstock. Progeny of the hatchery program are typically passed upstream above the Tucannon trap to spawn naturally. In 2008, only one pair (of natural-origin steelhead) was collected for broodstock, resulting in a fry release of 2,400. There will be no yearling release in 2009. So that the program can meet its broodstock goals, in 2009, WDFW plans to utilize both natural-origin and endemic hatchery-origin returns. It is unclear whether this procedure will be applied if broodstock collection is low in future years. Discussions among the managers have also indicated that, should low production numbers (i.e. less than 8,000 fish at smolt release, ~3 females at trapping) occur in the future, the fish will not be reared full term, but released as parr/fingerlings in the upper Tucannon River. Less than 8,000 fish production would not allow enough fish for evaluations to occur.

- Two traps are used for collecting broodstock. There is a trap at Tucannon FH (river mile 35) and a temporary trap is installed approximately 11 miles downstream from Tucannon FH at river mile 24. This temporary trap is used to collect the majority of the broodstock since the area between the lower trap and Tucannon FH is the lower extent of the primary spawning area for the Tucannon River natural population.

- Broodstock are collected from February through March at the Tucannon trap on the Tucannon River. This represents only the early part of the run. Natural returns occur from mid-February

through mid-May. Broodstock are collected early to increase time at the hatchery in order to increase the potential for creating a one-year old smolt with the appropriate size at release.

- Tucannon steelhead, as part of the Snake River DPS, are listed as threatened under the Endangered Species Act.

Hatchery and Natural Spawning, Adult Returns

- Tribal harvest of marked and unmarked steelhead occurs in the lower Columbia River.

- The proportion of endemic hatchery-origin to natural-origin adult returns to the Tucannon FH trap is approximately 50%.

- The proportion of Lyons Ferry FH stock to the endemic Tucannon FH stock is approximately 5% at the Tucannon FH trap. The proportion of Lyons Ferry stock that reach the temporary trap in the lower river is much higher.

- PIT tag data indicates that, on average, 52% of the hatchery-origin Tucannon River stock pass Lower Granite Dam and remain above the dam. This is approximately the same percent for the natural-origin Tucannon River stock. Of the total number that ascend Lower Granite Dam, approximately 20% of those fish fall back below the dam after overwintering above. These unmarked Tucannon stock steelhead that pass above the dam are not subject to selective fisheries.

- Touchet and Tucannon summer steelhead have been documented in the area above Lower Granite Dam for years. However, the recent documentation of them entering and spawning in Asotin Creek, or other tributaries above Lower Granite Dam may be of concern. The endemic steelhead programs in the Touchet and Tucannon have been marked with PIT tags since 2001 (WDFW 2008 draft report on Touchet and Tucannon River summer steelhead).

- Approximately 55.1 % (27 of 49) of adult natural Tucannon River steelhead trapped at the lower river temporary weir in run year 2006 were hauled to Lyons Ferry FH for broodstock.

- Spawning ground surveys occur in the Tucannon River; however, conditions limit the information obtained.

- Estimated smolt to adult (upstream of McNary Dam) survival rate of PIT tagged naturally produced smolts averaged 1.75% for 1999-2006 smolt migration year (Table 1 of WDFW 2008 draft evaluation report).

- For the endemic hatchery program, estimated smolt to adult (upstream of McNary Dam) survival rate averaged 0.66 % for 2004-2006 release years (Table 2 of WDFW 2008 draft evaluation report).

- Based on a combination of spawning ground surveys and weir counts, the estimated annual spawning escapement for the Tucannon River is approximately 600-800 adult steelhead, with 60-70% being hatchery origin (both endemic and Lyons Ferry FH stocks). The recovery goal is 1,000 naturally produced adults

- Weirs on the Tucannon and Touchet rivers are used to control upstream passage of Lyons Ferry stock hatchery steelhead. The goal is to only pass natural-origin and endemic program-origin steelhead above the weirs; however, stream conditions (high flows) allow for uncontrolled passage

above the weirs. The Touchet River more often is not capable of controlling upstream passage compared to the Tucannon River. Recent modifications to the weirs (passage panels) have improved control of fish passage. Hatchery staff estimate that trapping efficiencies have increased from around 50% to 90-95% for adult steelhead trapping (based on observed adult steelhead carcasses recovered above the weir, without opercle punches which are applied to all steelhead trapped and released above the weir at Tucannon FH). During high flows when the weir panels swing out, some steelhead may be swimming through the weir or jumping over the weir structure.

- Results of a genetic analysis of southeast Washington summer steelhead populations indicate that Lyons Ferry and Tucannon steelhead stocks have high genetic similaries, reinforcing WDFW's interpretations that significant genetic introgression has occurred between Lyons Ferry FH stock and the Tucannon steelhead stock. (*see Research, Education and Outreach section under Lyons Ferry stock steelhead for a complete description*).

- Based on broodyear 2005, the smolt-to-adult return rate for the program is approximately 1.3%. In previous years, the SARs were lower, likely affected by size and time at release. Early on, SARs varied among size at release.

- From 2000-2007, on average 15 females (12-18) and 15 males (7-19) were spawned annually.

- Adult males are PIT tagged when they are collected to track the number of times they are used during spawning.

- Adults are transferred and held in an adult holding raceway at Lyons Ferry FH prior to spawning.

- Touchet and Tucannon stock are held in the same adult holding raceway, separated by a bar rack. Touchet are held downstream of the Tucannon stock due to the increased prevalence of IHNV in Touchet stock; however, transmission of IHNV or other pathogens, between the two stocks is still possible. The adult holding pond is split because there is limited space for holding multiple stocks of adults at Lyons Ferry FH.

- Females are kill spawned and males are live spawned, then passed above the weir on the Tucannon River. The males are held until all spawning is complete, then transferred back to the Tucannon River and released above the weir.

- MS-222 is used to anesthetize adult steelhead when spawning.

- Spawning occurs from early-March through mid-April on a weekly basis. Four to seven spawn takes occur over this time period.

- The steelhead are spawned performing a 2x2 factorial cross.

- WDFW follows the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Requirements include testing salmonid broodstock for regulated pathogens that are untreatable and that cause serious mortality (such as IHNV and other viruses In steelhead broodstock, tests for reportable pathogens such as *R. salmoninarum*, other bacteria, and parasites (excluding *M. cerebralis*, a regulated pathogen) are not required by policy.

- All females are tested for viruses, including IHNV.

Incubation and Rearing

- Tucannon stock steelhead average about 5,000 eggs per female.

- The first detection of IHNV in the Tucannon adults occurred in 2009. The WDFW policy for another listed stock, the Touchet steelhead reared at Lyons Ferry FH, has been to quarantine the eggs from IHNV-positive females and after hatch, outplant as buttoned-up, unfed fry near Cumming Creek Bridge, which is about a mile below the Tucannon FH (RM 34.7). Outplanting button-up fry from IHN females is considered low risk because virus outbreaks in the juvenile progeny are rare (e.g. there hasn't been an IHN outbreak in the Lyons Ferry stock juveniles since 1992).

- Fertilized eggs are water hardened in 100-ppm iodophore. They are incubated until the eyed-egg stage in down-welling iso-incubation buckets (one female per bucket). Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus includes daily treatment with formalin (1:600). Non-viable eggs and sac-fry are removed by hand picking with egg pickers or bulb-syringe.

- After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs at 1 hatching basket per trough. Eggs from approximately 2 females are loaded in each basket (approx 10,000 eyed eggs). Eggs are inventoried and identified by female parent. Formalin treatment is discontinued once the eggs eye up and are transferred to the hatching baskets.

- 1 battery or 8 troughs are used for early incubation in the Tucannon stock program. Flow is on average 8 gallons per minute (6-10 gallons per minute). The maximum rearing density in the shallow troughs is 0.99 DI (at 700 fish per pound).

- During early rearing, feed rate and frequency is manipulated to accelerate the growth rate of late take progeny to achieve a mean size that is close to the mean size of early take progeny before they are transferred to the intermediate tanks.

- The steelhead are transferred to two indoor intermediate tanks (4x27x 2 feet in depth) in June. The flow for the intermediate tanks are 60 gpm. The maximum rearing density in the intermediate tanks is 0.33 DI (at 175 fish per pound).

- Fish rear in intermediate tanks until August or when fish reach 150-200 fish per pound, at which time they are transferred to 1, 10x88 outdoor raceway.

- When the steelhead are moved outside, the coefficient of variation in the population increases to 10%.

- The flow in the raceways ranges from 500 to 1000 gallons per minute. Flow index in the raceways ranges from 0.03 at initial ponding (500 gpm) to 0.55 (1000 gpm) before the fish are transferred for release.

- The maximum rearing density in the raceways is 0.2 DI (at 4.5 fish per pound).

- In January, at 30-35 fish per pound, the steelhead are coded-wire tagged. After the steelhead are tagged, they are size graded and split into two 10x88 raceways, one containing the smaller sized

group and the other, the larger sized group. The two groups then receive PIT tags proportionate to the number of steelhead in each size group.

- At Lyons Ferry FH, incubation and rearing occurs in sediment free, 51-53 degree F (11 C) well water.

- In February, at 6 fish per pound, the steelhead are transferred to Tucannon FH for acclimation prior to release. The larger sized steelhead are reared in the 15x136 x 5 feet in water depth raceway (800 gpm). The smaller sized steelhead are reared in two 10x80 x 3 feet in water depth raceways (250 gpm). The maximum densities for the larger and smaller ponds, immediately prior to transfer and direct-stream release, are 0.01 and 0.02 DI, respectively. The maximum flow indices are 0.11 and 0.15, respectively.

- The water temperature for the raceways at Tucannon FH averages 45 degrees F (range 40-50 degrees F) while the steelhead are on station.

- Fry/fingerling are fed dry diet. Fry feeding starts at ~3-8 times daily (7 days per week) and is reduced for larger sized group of fish once the fish are graded and into separate raceways. Range of feeding varies between 1.5 – 3.5% of the fishes' body weight per day. Feed conversion is expected to fall in the range of 0.8:1.0 to 1.2:1.0 (dry feed) pounds fed to pounds produced. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance with program goals.

- Based on broodyears 2000-2007, green egg to fry survival is approximately 90% and fry to smolt survival is approximately 93%.

- Fish health checks occur at least monthly. Treatment for disease is provided by WDFW Fish Hatchery Specialists (hatchery staff) under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning once per week by brushing, and disinfecting equipment between raceways and/or between stocks on the hatchery site. Mortalities are removed from the raceways daily.

- Cold water disease can be experienced after ponding to the raceways.

- When in the raceways, the juveniles receive medicated feed (florfenicol) when fish mortalities due to cold water disease reach over 100 per raceway per day. In 2006, fish were treated with "fish pills" coated with florfenicol to provide a 15 mg drug/kg fish weight treatment for 10 days. Disease abates in the raceways before marking occurs and is not a factor in the fish by the time they are transferred. ł

- Hatchery staff indicate that the Tucannon endemic stock fish appear more "domesticated" based on behavior than the Touchet River stock when these fish are in the hatchery (WDFW 2008 draft report on Touchet and Tucannon River summer steelhead).

- The better performance of the Tucannon River stock compared to the Touchet River stock is likely a factor of successfully rearing this group up to the program release size by the desired date. There is a likelihood that this group is more closely related to the Lyons Ferry FH stock of fish and thus successfully responds to hatchery rearing practices (WDFW 2008 draft report on Touchet and Tucannon River summer steelhead).

Release and Outmigration

- All Tucannon stock steelhead are released as yearling smolts, about 12 months after the parents were initially spawned.

- All steelhead smolts for the program are planned for a release size of 4.5 fish per pound.

- Length sampling occurs immediately prior to transfer and direct-stream release. The average length of the steelhead reared is 210-215mm. NOAA Fisheries guidelines under the ESA require the release of summer steelhead at lengths ranging from 180 to 250 mm. At release the coefficient of variation ranges from 11-14%.

- The steelhead are transferred from Tucannon FH and direct-stream released into the Tucannon River at Camp Wooten Bridge (river mile 42). Until 2007, the steelhead were released directly below the Curl Lake intake (river mile 41), upstream of Tucannon FH. However, the river changed so that the pool below the intake was not a good release point. Release occurs in mid-April.

- Minimum estimate of steelhead residualism for Tucannon stock steelhead in the Tucannon River from 2001 through 2005 averaged 7.7% (range 6.0%-9.9%).

- No pre-release exams are performed.

- Between 2001 and 2008, the average number of smolts release was 55,559 (range 43,000-65,200).

Facilities and Operations

Lyons Ferry FH (see Lyons Ferry fall Chinook and steelhead programs), Tucannon FH (see the spring Chinook program)

Research, Education, and Outreach

- To estimate survival from smolt to adult and to identify the hatchery steelhead during broodstock collection and when managing upstream passage, all Tucannon River endemic stock steelhead are coded-wire tagged with no external fin clips. 8,000-10,000 fish are PIT tagged to improve data gathering. The use of PIT tags is an alternate means to calculate smolt-to-adult survivals for program evaluation.

- Over the last few years, evaluation staff have annually PIT tagged portions of the Tucannon River endemic stock group (by size) prior to release. PIT tags are being used to document smolt-to-adult survival rates. Results to date showed that, originally, the group that was released per program goals and release time, survived nearly twice the rate as those released later and sometimes at a smaller size. More recently, the larger and smaller sized fish release groups' smolt-to-adult survival rates have become more equal.

- An initiative is being developed among LSRCP comanagers to standardize monitoring and evaluation and create a standardized data management system for data entry and reporting.

- Lyons Ferry FH and Tucannon FH work to provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Lyons Ferry FH, Tucannon FH and LSRCP programs. The Dayton Lab monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex.

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[81] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- Currently, there are no recreational harvest benefits in the Tucannon River associated with this program. Tucannon River steelhead are not adipose-fin clipped and are not available for mark selective fisheries. The long-term goal of the program is to replace the Lyons Ferry stock currently released in the Tucannon River to sustain the recreational fishery there.

- Unmarked steelhead may contribute to the recreational fishery in the Tucannon River as catch and release fish.

Conservation Benefits

- Currently, the program operates to increase the number of naturally reproducing Tucannon River steelhead. This is accomplished by allowing Tucannon River endemic stock returning hatchery adults to spawn in prime rearing areas.

Research, Education, Outreach and Cultural Benefits

- Evaluates whether a hatchery program utilizing endemic steelhead can be developed for long-term harvest benefits. The Tucannon River endemic stock program has been more successful in returning adult steelhead to the project area above McNary Dam (especially in more recent years). However, estimated smolt-to-adult survival of endemic stock fish is well below what has been documented from Lyons Ferry stock steelhead releases in the Tucannon River, and from natural origin steelhead smolts produced from the Tucannon River.

- Evaluates the use of hatchery production for the restoration of a wild steelhead population.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[82] the Review Team identified the following benefits of this program:

Harvest Benefits

- Tucannon River stock steelhead may be harvested in non-selective fisheries downstream of the Tucannon River, primarily in zone 6 tribal gillnet fisheries, between Bonneville and McNary dams. Coded-wire tag recoveries on non-adipose fin clipped fish are extremely limited. The long-term goal of the program is to replace the Lyons Ferry stock currently released in the Tucannon River which may continue to contribute to fisheries downstream of the project area.

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[81] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*
[82] *Ibid.*

- Unmarked steelhead may contribute to recreational fisheries as catch and release fish downstream of the project area.

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Contributes to the body of research regarding the development of endemic hatchery programs for harvest, regarding the use of nontraditional rearing techniques; and regarding the use of hatchery propagation for the restoration of wild steelhead populations.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[83] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- The comparatively small effective breeding number of the broodstock (mean N_b <36) coupled with the deliberate upstream passage of endemic Tucannon FH-origin adult steelhead poses a genetic risk to the natural population by reducing the effective population size via genetic swamping by hatchery-origin fish representing a small number of parents (Ryman-Laikre Effect).

- Utilizing only the early portion of the Tucannon River run for broodstock, then allowing the hatchery progeny of those steelhead passage upstream to spawn naturally may, over the long term, impose artificial selection for earlier run timing in the natural population. This issue is correlated with the preceding issue.

- As a consequence of the two preceding risks, broodstock management practices coupled with upstream passage of hatchery fish for natural spawning are expected to reduce genetic variation in the natural population.

- Use of a local stock may have less detrimental effects to listed Tucannon River steelhead than the Lyons Ferry stock currently released in the Tucannon River should these fish return to the spawning grounds. The program may reduce the potential for genetic introgression and depression that can occur with continued release of the existing Lyons Ferry FH stock into the Tucannon River.

Demographic Risks

- Inefficient adult capture at the lower and upper weirs reduces the potential for meeting broodstock collection goals.

- Crowding, loading, and transportation of adults at the Tucannon River traps pose fish health risks and potential mortality to the adults and progeny.

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[83] *Ibid.*

- High densities during early rearing (when the steelhead are in the shallow troughs) could lead to fish health issues.

- Crowding and loading of fish onto trucks for transportation to release sites poses risks that do not occur with on-station releases. This extra handling associated with transportation may physically harm the fish, which may be contributing to increased post-release mortality.

- Transportation to release sites poses a demographic risk to the stock during transport and unknown physiological (stress) risks during transport and following release.

- Limited control (at the weirs) of upstream passage of adult hatchery-origin steelhead (both Tucannon and Lyons Ferry stock) during high flows poses genetic and ecological risks to the natural-origin Tucannon River steelhead population.

- The location of the permanent weir, above 40% of the primary spawning area for the natural population, and the inefficient temporary weir below the primary spawning area restrict the management of the proportion of hatchery steelhead on the spawning grounds, posing genetic and ecological risks to the natural-origin population.

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in raceways that are over loaded. .

- The four Columbia River and two Snake River dams significantly reduce the survival of outmigrating juveniles and returning adults, posing a demographic risk to the return of sufficient numbers of adults for harvest on a consistent basis.

Ecological Risks

- Amplification of disease within the hatchery poses a disease risk to the propagated stock.

- Adult male steelhead held for broodstock and returned to the Tucannon River may transmit diseases from Lyons Ferry FH to the natural population in the Tucannon River.

- The release of fry that are progeny of IHN virus positive females may pose fish health risks to the Tucannon River natural population, however, the risk is considered low due to egg disinfection.

- Tucannon stock steelhead are held in the same adult holding pond as Touchet stock steelhead, posing a fish health risk to both stocks. Of special concern is the transmission of the IHN virus.

- Hatchery-origin steelhead that residualize pose ecological risks to the natural-origin Tucannon River population.

- Large bird colonies on artificial islands located on artificial islands in Lake Wallula, near the mouths of the Snake and Walla Walla Rivers and in the downstream reservoirs and Columbia River Estuary consume significant numbers of steelhead, posing an ecological risk to Tucannon stock steelhead. 23% of PIT tagged Snake River steelhead are reported to be consumed by avian predators in the estuary.[84]

[84] www.birdresearchnw.org. *Dan Robie, OSU principal investigator.*

Physical Risks

- See the Lyons Ferry fall Chinook and Tucannon spring Chinook sections.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[85] the Review Team identified the following risks from the hatchery program:

Genetic Risks

- The Tucannon River stock steelhead that migrate above Lower Granite Dam and do not fall back and return to Tucannon River may stray, posing a genetic risk to other steelhead stocks.

- The practice of direct-stream releasing (outplanting) endemic stock Tucannon River steelhead may increase their stray rates, posing genetic and ecological risks to other steelhead stocks.

Demographic Risks

- Lyons Ferry FH was not designed to rear multiple stocks in lots of varying sizes. This creates the potential for exceeding maximum rearing densities in raceways that are over loaded.

- Operation of weirs and traps for spring Chinook and steelhead hatchery programs in the Tucannon River pose risks of migration blockage, injury, and stress to other endemic fish species within the Tucannon Basin.

Ecological Risks

See the genetic risks section above.

- Rearing progeny of IHN virus positive females may pose fish health risks to other fish reared on station at Lyons Ferry FH; however, the risk is considered low due to egg disinfection and isolated rearing.

- Tucannon steelhead are held in the same adult holding pond as Touchet steelhead, posing a fish health risk to both stocks. Of special concern is the transmission of the IHN virus.

- Hatchery-origin steelhead that residualize may pose ecological risks to other species including bull trout.

- The collection and barging of steelhead smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

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[85] *Ibid.*

Research, Education, Outreach and Cultural Risks

- None identified

Recommendations for Current Program[86]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue TR-SS1: The Review Team understands that the goal of the program is to "evaluate the capability of developing an endemic Tucannon River hatchery stock that can replace the Lyons Ferry stock for meeting harvest mitigation goals while, at the same time and if successful, be used to maintain and/or increase numbers of naturally reproducing Tucannon River steelhead that successfully produce viable progeny." *The Team concluded that the current size and scope of the program are consistent with the research goal but not with the goal of rebuilding a natural population via natural spawning supplementation by hatchery-origin fish (see Issues that follow). Management actions and operations inconsistent with the scope and goal of any hatchery program can pose significant risks to natural populations with little likelihood of achieving the intended benefits in most cases. Consequently, the deliberate passage of hatchery-origin fish upstream to spawn naturally and/or the direct release of hatchery-origin fry and smolts upstream of the weir won't achieve the purpose of the current program.*

Recommendation TR-SS1: Clearly define the specific goals and objectives (specific, measurable, attainable, realistic, with a timeframe) for the current endemic broodstock program and the methods and metrics for achieving the goals.

Issue TR-SS2: A substantial amount of information and knowledge has been acquired to determine whether Tucannon steelhead can replace the Lyons Ferry stock for meeting harvest mitigation goals in the project area; however, no action has been taken based upon that information. *Survival and fish culture data have been collected for seven years.*

Recommendation TR-SS2: Use the existing information to determine whether Tucannon steelhead can replace Lyons Ferry stock steelhead for harvest mitigation purposes.

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[86] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

Issue TR-SS3: The long-term conservation goal of this program is unclear. *The Team could not determine whether the long-term goal of the program is to preserve the genetic legacy of the unique Tucannon River steelhead stock (e.g. redfish lake sockeye program) or to yield a viable, self-sustaining natural population of steelhead in the Tucannon River that contribute to the recovery of the Snake River DPS (e.g. Methow River steelhead for the Upper Columbia steelhead DPS). The objectives and management actions for this program would conceivably be quite different depending upon the long-term conservation goal.*

Recommendation TR-SS3: Clearly define the long-term conservation goal of this program.

Broodstock Choice and Collection

Issue TR-SS4: Utilizing only the early portion of the Tucannon River run for broodstock, then allowing the hatchery progeny of those steelhead passage upstream to spawn naturally may, over the long term, impose artificial selection for earlier run timing in the natural population*. Tucannon River steelhead return from mid February through mid May; however, only February through March returns are used for broodstock. Collecting only the early portion of the run is performed so that the progeny can be reared and released as one-year-old smolts.*

Recommendation TR-SS4: Collect steelhead for broodstock from the entire spectrum of the run.

Hatchery and Natural Spawning, Adult Returns

Issue TR-SS5. The genetic effective number of breeders for the broodstock is too low to support a natural spawning supplementation program under the current research goals of the program. *Hatchery-origin steelhead of the endemic Tucannon River stock are passed upstream to spawn naturally in the Tucannon River because NOAA Fisheries includes those fish with the ESA listed Snake River Summer Steelhead DPS. However, the deliberate release of those fish upstream to spawn naturally is not consistent with the research goals of the program. The deliberate release of hatchery-origin fish upstream also poses a genetic risk to the natural population because the mean effective number of breeders (parents) per year is only N_e = 27.2 adults, and endemic hatchery-origin fish compose up to 50% of the naturally spawning populaton in the Tucannon River.*

Recommendation TR-SS5: Discontinue passing hatchery-origin steelhead upstream to spawn naturally. Increase the number of steelhead collected for broodstock to yield a minimum effective number of breeders each year of $N_b > 50$. This could be accomplished by spawning equal numbers of endemic hatchery and natural-origin fish pairwise within each of the 2x2 spawning matrices: HxW and WxH, respectively. This would yield a value of *pNOB* = 50%.

Issue TR-SS6a: Adult male steelhead held for broodstock and returned to the Tucannon River may transmit diseases from Lyons Ferry FH to the natural population in the Tucannon River*. Of special concern is the transmission of the IHN virus.*

Issue TR-SS6b: Adult male steelhead transported and utilized multiple times during spawning, then returned to the Tucannon River experience excessive stress, increasing the potential for fish health issues. *Males returned to the Tucannon River likely die shortly after release.*

Recommendation TR-SS6: Discontinue the return and release of adult male steelhead into the Tucannon River.

Incubation and Rearing

See Issue LF-SS8 and Issue CC-SS8.

Issue TR-SS7: Rearing densities in the indoor nursery tanks "shallow troughs" (1.15 max DI) exceed culture guidelines for steelhead, thus increasing fish health risks. *Due to space limitations in the intermediate and outdoor raceways, steelhead are held in the troughs beyond recommended rearing densities for steelhead. This protocol results in density indexes attaining D.I. = 1.15 in the indoor nursery tanks prior to transfer to the outdoor raceways.*

Recommendation TR-SS7: Reduce rearing densities in the shallow troughs to a maximum of D.I. = 0.5 by increasing the number of nursery rearing or intermediate rearing tanks (see LF-SS12), by reducing the total number of Lyons Ferry steelhead reared, by reducing the number of fish reared in other programs, or by reducing the total number of stocks reared at Lyons Ferry FH.

Release and Outmigration

Issue TR-SS8: Outplanting fry that are progeny of IHN virus positive females may pose fish health risks to the Tucannon River natural population. *The risk of the IHN virus being transferred to the progeny is low due to egg disinfection. However, releases still pose fish health risks to natural-origin steelhead populations compared to the low potential benefits. Studies indicate that outplants at the subyearling fry stage have shown extremely low survivals to adulthood and may actually pose significant ecological risks by displacing natural-origin fry which are generally smaller than hatchery-origin fry at the time of outplanting.* [87,88]

Recommendation TR-SS8: Discontinue outplanting fry. If the program size is increased, consider sampling the fry for viruses and retain and rear the group to smolt-stage only if they are IHN virus negative.

Issue TR-SS9: Pre-release exams which include testing for virus, bacteria and parasites are not done at the Lyons Ferry FH Complex and associated acclimation sites. *There is a potential risk that endemic or vertically transmitted diseases might be undetected in released juveniles. This could affect their future survival and/or infected fish could serve as vectors in infecting other aquatic animals . Pre-release inspections, done 4-6 weeks before release or transfer are required by USFWS fish health policy FW 713.*

Recommendation TR-SS9: Sample 60 fish for pre-release inspections to meet the American Fisheries Society – Fish Health Section Blue Book requirements to ensure a 95% confidence in detecting pathogens at the minimum assumed pathogen prevalence level of 5%. Additional

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[87] *Nickelson, T.E., M.F. Solazzi, and S.L. Johnson. 1986. Use of hatchery coho salmon (Oncorhynchus kisutch) to rebuild wild populations in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences 43: 2443-2449*
[88] *Kostow, K., A. Marshall, and S.R. Phelps. 2003. Natural Spawning Hatchery Steelhead Contribute to Smolt Production but Experience Low Reproductive Success. Transactions of the American Fisheries Society 132: 780-790.*

testing for non-reportable pathogens, such as *Flavobacterium psychrophilum* and *Nucleospora salmonis*, may be informative for co-managers.

Issue TR-SS10: Discussions among the managers have also indicated that, should low production numbers (i.e. less than 8,000 fish at smolt release, ~3 females at trapping) occur in the future, the fish will not be reared full term, but released as parr/fingerlings in the upper Tucannon River. *Studies indicate that outplants at the subyearling fry stage have shown extremely low survivals to adulthood and may also pose significant ecological risks to natural populations by displacing natural-origin fry which are generally smaller than hatchery-origin fry at the time of outplanting.* [89]

Recommendation TR-SS10: Either release the adults so that they can spawn naturally or rear the progeny and release them as smolts per the current program guidelines. The fate of the returning adults of such broodyears should be determined as part of a detailed contingency planning that considers the relative proportions of returning adults composed of hatchery-origin fish of that broodyear and natural-origin fish.[90]

Facilities/Operations

Tucannon FH and Trap

(See the Tucannon spring Chinook section for additional facility issues and recommendations)

Issue TR-SS11: The temporary weir located below the Tucannon steelhead primary spawning area is ineffective at collecting sufficient numbers of natural and endemic steelhead for endemic program broodstock and is ineffective at excluding Lyons Ferry steelhead from natural spawning areas. *Recent modifications have been made to the permanent weir upstream of the temporary weir that increased its trapping efficiencies from 50% to 90-95%. However, approximately 40% of the natural spawning occurs between the site of the lower temporary weir and the permanent weir and an insufficient number of adults are available at the upper weir to meet broodstock needs. For this conservation program, all adults must be accessed and monitored downstream from their natural spawning areas.*

Recommendation TR-SS11: Investigate the feasibility of constructing a permanent weir in the lower Tucannon River, below the primary spawning areas. A permanent weir in the lower river would also provide a site for collecting spring Chinook broodstock (see Issue and Recommendation TR-SC3 in the Tucannon River spring Chinook section).

Lyons Ferry FH

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[89] *Same as previous two footnotes.*

[90] *For example, if only 60 fish returned to the Tucannon River and 50 of them were the hatchery-origin fish of the (subject) broodyear, then the contingency plan may be to allow all fish to go upstream to spawn naturally. On the other hand, if 100 fish returned and 50 were hatchery-origin and 50 were natural origin, then you may want to restrict the number of hatchery fish passed upstream to 10 to reduce impacts to the naturally spawning population. The remaining 40 hatchery fish should be removed. Such contingency plans need to weigh demographic benefits (which may be negligible) versus genetic risks (which may be significant) in all decisions regarding deliberate passage of hatchery-origin fish. These decisions must be based on the scientific literature and not based on undocumented presumptions.*

(See the Lyons Ferry FH Steelhead and Fall Chinook sections for additional facility issues and recommendations)

Issue TR-SS12: Tucannon and Touchet steelhead stocks are held in the same adult holding pond at Lyons Ferry FH. *The two stocks are separated by a grated partition that splits the pond. Holding two stocks of steelhead in the same pond increases the potential for disease transmission between the stocks.*

Recommendation TR-SS12: Consult with engineering to modify existing holding facilities or build new holding ponds so that the stocks can be held separately on first pass water.

Research, Monitoring, and Accountability

Issue TR-SS13: Steelhead in the Tucannon River (natural-origin steelhead and Tucannon endemic and Lyons Ferry stock steelhead released into the Tucannon River) have a high degree of straying upstream of Little Goose and Lower Granite dam and into tributaries including Asotin Creek(?). *Off-site releases of hatchery reared salmon and steelhead (regardless as to whether they were acclimated or direct stream releases) have consistently demonstrated reduced homing abilities in returning adults (Evenson 1992, Vander Haegen 1995, Johnson 1990). Current hatchery practices may be contributing to these stray rates, including the practice of rearing the fish to smolt stage at Lyons Ferry FH, then transporting them and direct stream releasing them in the Tucannon River, posing genetic and ecological risks to other steelhead stocks. Facilities at mainstem dams to accommodate passage of migrating adults both upstream and downstream may also be inadequate.*

Recommendation TR-SS13a: Continue to investigate the degree of homing and straying and experiment with rearing and release strategies to reduce straying. Investigate the feasibility of incubating and rearing Tucannon steelhead at the Tucannon FH to increase homing and reduce straying.

Recommendation TT-SS13b: Continue to investigate safe passage of adult steelhead, both upstream and downstream of mainstem dams.

Issue TR-SS14: Current marking and tagging practices are suitable for achieving current program objectives*. Tucannon stock are coded- tagged so that the hatchery fish can be distinguished from natural-origin fish when they return to the trap. 8,000-10,000 steelhead are PIT tagged to provide survival and stray data.*

Recommendation TR-SS14: Continue the current marking and tagging practices. Consider increasing the number of steelhead PIT tagged to 10,000-15,000 so that smolt-to-adult survival can be estimated, given that survival rates associated with this endemic program currently vary and are at times low.

Education and Outreach

See the Lyons Ferry Fall Chinook and Tucannon Spring Chinook sections for Education and Outreach issues and recommendations regarding Lyons Ferry FH and Tucannon FH.

Alternatives to Current Program

The Review Team considered the benefits and risks of the existing B-run steelhead program at Clearwater FH and developed seven alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

Alternative 1: Current program with recommendations

Continue the current endemic summer steelhead program on the Tucannon River with implementation of all recommendations. Clearly define the specific goals and objectives (specific, measurable, attainable, realistic, with a timeframe) for the current endemic broodstock program and the methods and metrics for achieving the goals. Collect adult steelhead from throughout the natural run time and discontinue passing all hatchery-origin steelhead (including endemic Tucannon fish) above the upper weir while continuing to pass all natural-origin steelhead upstream to reduce genetic risks to the natural population.

Pros

- Promotes development of a local broodstock to replace Lyons Ferry stock in the Tucannon River, potentially reducing genetic and ecological risks to the listed steelhead stock.
- Could serve as a potential genetic reserve for the listed Tucannon River population and a conservation program for the Tucannon River population, above the weir, but only if the program is expanded for that specific purpose.
- Could reduce the demographic risk of extinction and potentially contribute to the recovery of the Snake River steelhead DPS, but only if the program is expanded for that specific purpose.

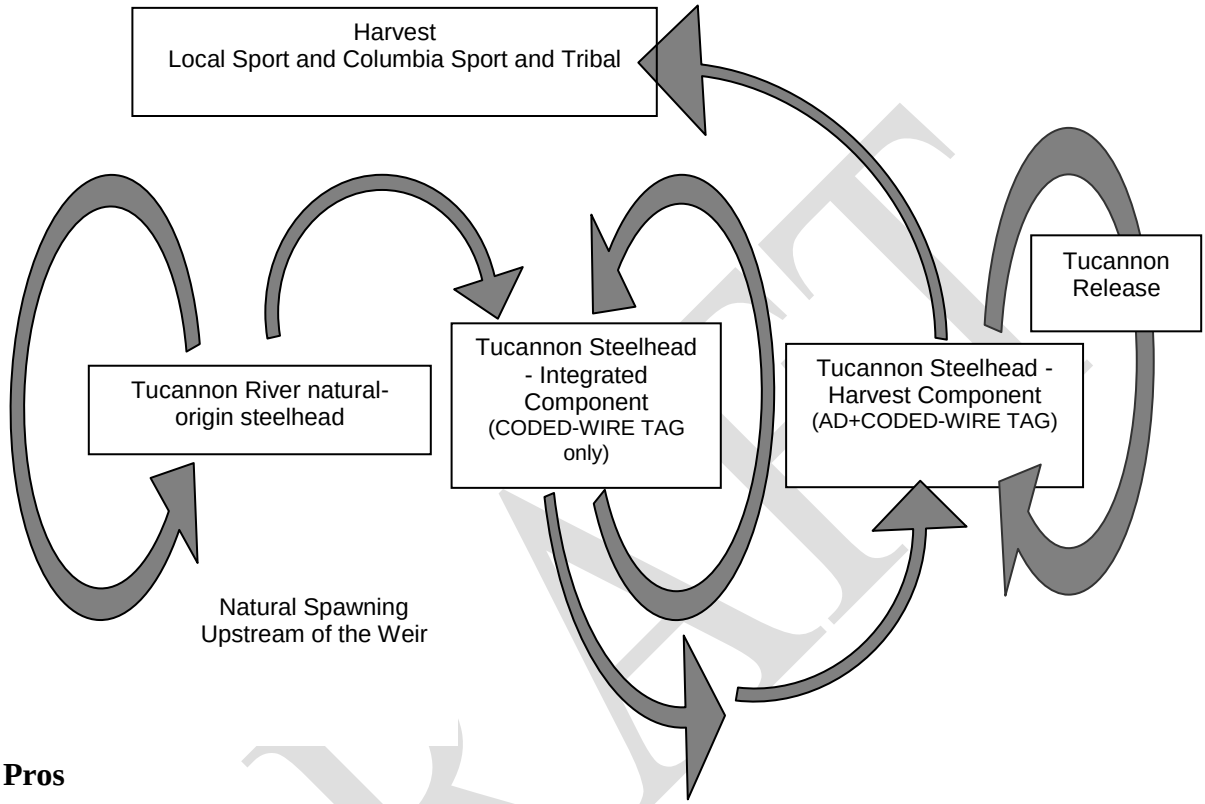
Cons

- Maintains the risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Tucannon River.
- Reduces slightly the number of fish available for harvest by utilizing space at Lyons Ferry FH that could be used for harvest program fish (e.g. Lyons Ferry stock).
- Slightly reduces the number of natural-origin steelhead spawning naturally in the Tucannon River.

Alternative 2: Expand the Tucannon endemic steelhead program by creating a stepping-stone program for harvest and conservation

Utilize returning hatchery origin endemic Tucannon stock as broodstock and cross with natural origin steelhead from the Tucannon traps to create a stepping-stone program for harvest with potential conservation benefits. This could be accomplished at Lyons Ferry FH by differentially marking broodstock where the integrated conservation component would be coded-wire tag-only and the

harvest component would be adipose-fin clip/coded-wire tag. Collect enough natural origin adults to produce a PNOB of 0.5 and a PHOS as close to 0.0 as possible. As local broodstock collection ability increases over the long term, phase out Lyons Ferry stock steelhead and replace with the Tucannon stock for harvest purposes. This alternative would require replacing the temporary weir with a permanent weir in the lower Tucannon River.



Pros

- Contributes to sport and tribal fisheries in the Tucannon, Snake, and Columbia rivers.
- Promotes development of a local broodstock to replace Lyons Ferry stock in the Tucannon River, potentially reducing genetic and ecological risks to the listed steelhead stock.
- Serves as a genetic reserve for the listed Tucannon River population and a conservation program for the Tucannon River population, above the upper weir.
- Reduces the demographic risk of extinction and potentially contributes to the recovery of the Snake River steelhead DPS.

Cons

- Further complicates rearing at the Lyons Ferry FH that already has space limitations.
- The risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Tucannon River would still exist.

- Temporarily reduces the number of fish available for harvest by utilizing space at Lyons Ferry FH that could be used for harvest program fish (Lyons Ferry stock) until the Tucannon population is large enough for harvest management.

- Reduces the number of natural-origin steelhead spawning naturally in the Tucannon River.

- Incidental take limitations of ESA-listed natural-origin Tucannon River steelhead may limit harvest opportunity for hatchery-origin steelhead in the lower Tucannon River.

- Could increase the number of steelhead that stray above Little Goose and Lower Granite dams.

Alternative 3: Expand the Tucannon endemic steelhead program by creating a segregated, for harvest program downstream of the weir and managing the population upstream of the lower weir for natural production only.

Manage the hatchery program as a segregated program while passing only natural-origin adults upstream of the lower weir for conservation of the Tucannon River stock. This alternative would require replacing the temporary weir with a permanent weir in the lower Tucannon River.

Pros

- Maintains current harvest benefits.

- Reduces or eliminates hatchery influence on the Tucannon River natural-origin steelhead population above the new weir in the lower Tucannon River.

- Over the long-term, the program is not dependent on the natural population as a broodstock source, eliminating any take of natural-origin adults for broodstock.

Cons

- Cost associated with modifications to the lower weir to exclude hatchery-origin steelhead from the upper Tucannon River.

- The weir would still have to be operated to preclude hatchery fish from migrating upstream.

- Eliminates harvest opportunities for hatchery-origin steelhead above the lower weir location.

- The risk of transporting pathogens, including IHNV, from Lyons Ferry FH to the Tucannon River.

- Incidental take limitations of ESA-listed natural-origin Tucannon River steelhead may limit harvest opportunity for hatchery-origin steelhead in the lower Tucannon River.

- Could increase the number of steelhead that stray above Little Goose and Lower Granite dams.

Alternative 4: Rear Tucannon endemic steelhead to full term at Tucannon FH

Make necessary improvements to the Tucannon FH to rear Tucannon endemic steelhead for their complete captive rearing cycle.

Pros

- Reduces the number of stocks reared at Lyons Ferry FH.
- Eliminates the potential for transporting pathogens, including IHNV, from Lyons Ferry FH to the Tucannon River.
- Frees up rearing space at Lyons Ferry FH and reduces potential costs associated with modifying the facility to properly accommodate the Tucannon River steelhead program.
- May reduce straying of hatchery-origin Tucannon River steelhead since they will no longer be reared at Lyons Ferry FH.

Cons

- Costs associated with significant modification in infrastructure at Tucannon FH to accommodate the program.

Alternative 5: Terminate the Tucannon endemic steelhead program

Terminate the program in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site.

Pros

- Eliminates hatchery influence on the Tucannon River natural-origin steelhead population above the lower Tucannon River weir if the weir is modified so that it is an effective exclusion mechanism or if the releases of Lyons Ferry steelhead are discontinued and straying of hatchery fish into the Tucannon River is limited.
- Reduces the number of stocks reared at Lyons Ferry FH and increases the rearing space available for other Lyons Ferry FH programs.

Cons

- Continued cost associated with operating the weir to monitor the natural steelhead population and preclude hatchery-origin steelhead from migrating upstream.
- Cost associated with modifications to the lower weir to exclude hatchery-origin steelhead from the upper Tucannon River.
- Reduces sport harvest opportunities in the Tucannon River.

Recommended Alternatives

The Team recommends Alternative 2: phase-out or terminate the release of Lyons Ferry hatchery steelhead in the Tucannon River and expand the current integrated endemic program for steelhead to a

two-stage, stepping-stone program. Implementation of this alternative will require a permanent weir in the lower Tucannon River below the primary spawning habitat for steelhead so that the entire population can be intercepted and monitored. Alternative 2 is intended to be implemented consistent with all the recommendations in Alternative 1.

The intent of Alternative 2 is to address both conservation and harvest goals for steelhead in the Tucannon River. The Review Team understands that the primary purpose of the current endemic program is "research" to determine the potential efficacy of developing a localized integrated hatchery program as an alternative to the continued outplanting of non-native Lyons Ferry steelhead. The Review Team concluded that adult return rates back to the Tucannon River from the current endemic program were sufficient to expand the program for the immediate purpose of addressing conservation needs for steelhead in the Tucannon River. A second broodstock could be developed, based largely on adult returns from the first broodstock, to support Tribal and recreational fisheries. Adult returns from both broodstocks would contribute to the overall LSRCP mitigation goal for steelhead in the Snake River, while fish from the second "segregated" broodstock would contribute exclusively to the mitigation goal of 875 hatchery-origin steelhead available for harvest in the Tucannon River.

Gametes from adults trapped at the new weir constructed in the lower Tucannon River would be used to initially develop the integrated conservation component of the program, the size of which would be based annually on the returning natural population. The current endemic (*integrated*) program could be expanded to approximately 50 adults (25 females), without increasing the number of natural-origin adults used for broodstock, by retaining equal numbers of F1 hatchery-origin and natural-origin adults and crossing the two groups of fish pairwise (♀-nat. x ♂-hat., and ♀-nat. x ♂-hat.) - or in a spawning matrix - so that all progeny had at least one natural-origin parent. This spawning protocol would result in a value of *pNOB* = 50% for the first broodstock. Returning F1 hatchery-origin adults (tagged but not fin-clipped) surplus to the needs of the integrated broodstock would not be passed upstream but would be retained and spawned as a second broodstock to produce fish for harvest. These latter F2 hatchery-origin progeny would be given an adipose fin clip and, as returning adults, could be included in the second broodstock as needed by directly crossing them with returning adults resulting from the first broodstock (e.g., ♀-F1-hat. x ♂-F2-hat., and ♀-F2-hat. x ♂-F1-hat). This cross-breeding of natural-origin fish with F1 hatchery fish in the first broodstock, and F1 x F2 hatchery fish for the second broodstock would ensure (a) continuous gene flow from the natural population to the 2nd broodstock, thereby reducing genetic risks to the natural population, and (b) the absence of sibling matings. Surplus hatchery-origin adults produced from the first broodstock would, in general, not be passed upstream unless doing so was necessary to prevent extirpation or maintain minimal viability of the natural population.

The number of adults spawned for the second broodstock would be based on the 875-adult mitigation goal and the expected or predicted smolt-to-adult return rates back to the Tucannon River. For example, assuming a 0.65% smolt-to-adult return rate (SAR) back to the Tucannon River, approximately 135,000 smolts from the second broodstock would need to be released into the Tucannon River to achieve the mitigation return goal of 875 adult steelhead, and approximately 35 females (70 adults total) would need to be retained for broodstock to produce 135,000 smolts. As this "stepping stone" program develops, a greater proportion of the second broodstock could be composed of F1-hatchery fish from the first broodstock. No F2 hatchery-origin adults would be passed upstream to spawn naturally unless absolutely necessary as an emergency conservation measure.

Both components of the stepping stone program could be accomplished at Tucannon and Lyons Ferry fish hatcheries by differentially marking broodstock where the integrated conservation component would be coded-wire tag-only and the harvest component would be 100% adipose-fin clipped with

only a portion tagged for monitoring and evaluation purposes. The harvest component could be released at the weir.

The Team's recommendation is intended to meet near-term conservation goals for the Tucannon River population, while developing a harvest component to meet harvest and fishery management goals in the area. The Team's recommended alternative is also meant to be consistent with the intent of the current *US v. Oregon* agreement and LSRCP mitigation obligations. The Team also felt that our recommended alternative would be consistent with any potential actions that may be taken in the future to address ICTRT recovery recommendations.

The Team recognizes that Alternative 2 will require a significant investment to develop a weir and acclimation facilities in the lower Tucannon River, although the Team's recommendation could be initiated at the existing weir at the Tucannon Hatchery until such facilities are developed.

If comanagers conclude that implementing Alternative 2 is premature at this time, then the Team recommends implementation of Alternative 1: continuation of the current research program with implementation of all program specific recommendations. These recommendations include termination of the passage of hatchery-origin adults upstream of the weir because doing so creates genetic risks and is superfluous to the research goal of the program. Instead, those hatchery-origin fish should be crossed with natural-origin adults to further test the efficacy of the current program.

The Team did not support development of a new, segregated hatchery program for steelhead in the Tucannon River (Alternative 3), largely because it would inevitably create conflicts similar to the current program after many generations and would not – in the long term – provide conservation benefits for a natural population that may not be viable. The Team further assumed that the comanagers had good reasons for not rearing steelhead full-term at Tucannon Hatchery (Alternative 4). The Team also believed that termination of the current endemic program was premature from a research perspective (Alternative 5).

Spokane Rainbow Trout

Operator: Washington Department of Fish and Wildlife

Summary of Current Program

Goals

- ***Harvest goal:*** The goal of the trout programs associated with LFC hatcheries is to compensate for the loss of 67,500 angler-days of fishing in both Washington and Idaho to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams. There is no quantified harvest goal for this program. The Spokane Rainbow Trout program addresses fish primarily for release in Washington and Idaho lakes and ponds.

- ***Broodstock escapement goal:*** Eggs for the trout program are received from WDFW's Spokane FH.

- ***Conservation goal:*** None

- ***Escapement goal for natural-origin adults:*** Not applicable

- ***Research, education, and outreach goals:*** Provide accurate information and educational (I/E) opportunities for the public, media, schools, Tribal, State, and Federal agencies, and elected officials to enhance participation in understanding and stewardship of Lyons Ferry FH and LSRCP programs. The Dayton Lab monitors, evaluates, and coordinates fishery services and research activities for the Lyons Ferry FH Complex. The Idaho Department of Fish and Game (Clearwater Region, Lewiston Idaho) is responsible for Lyons Ferry FH rainbow trout released in Idaho.

Objectives

- The production objectives are 237,500 yearling and 160,000 sub-yearling Spokane rainbows. This requires 500,000 eyed Spokane rainbow trout eggs for the program. Watersheds currently targeted by the rainbow trout program include landlocked or screened lakes that have no access for anadromous salmon or steelhead.

Program Description

WDFW manages two hatcheries to produce resident trout for the LSRCP Program. This is a segregated mitigation program. When originally proposed, the trout program was to produce 233,000 trout at 2.5 fish per pound for a total of about 93,000 pounds. However, this production goal was adjusted to 86,000 pounds due to habitat mitigation efforts. Lyons Ferry FH was designed to rear 45,000 pounds of trout. Tucannon FH was designed to rear 41,000 pounds for the compensation program. Eggs for the trout program are received from WDFW's Spokane FH. IDFG receives 160,000 Spokane stock rainbow trout fry and transports these fish to designated Idaho waters (inland lakes and ponds) in April or May, at around 60-80 fish per pound. About 99,000 Spokane stock rainbow trout catchables (@ 2.5 fish per pound) and 500 jumbos (@ 1 fish per pound) are planted by Lyons Ferry FH drivers into various lakes in southeast Washington. Planting begins in February and is completed in March. At the Tucannon FH, approximately 137,400 Spokane stock rainbow trout are planted into

various lakes in southeast Washington as catchables. Planting typically begins in April, and is completed sometime in July. The jumbo trout (usually around 4,100) are planted in February through May each year, supplementing catchable plants. The LFC releases in Washington are in impounded waters (non-anadromous) that are primarily located in the Walla Walla, Snake, and Tucannon rivers, and Asotin Creek Watersheds.

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- Broodstock for the program are managed at the Spokane Fish Hatchery.
- Broodstock are periodically inspected for virus.
- One male is used per two females.
- Eggs are taken from only one year class (three or four year olds).
- Fish are spawned over a four week period; eggs representing each spawn take are provided for the Lyons Ferry FH Spokane rainbow trout program

Incubation and Rearing

- Eyed eggs received from Spokane Hatchery hatch from baskets at Lyons Ferry FH or Tucannon FH and drop into troughs where they remain for 4-8 weeks after feeding commences. Fish are fed after most are buttoned up (usually 1-3 days post swim up). [2002 Lyons Ferry Complex Rainbow Trout HGMP, P 19]
- After button up fish are then moved to intermediate inside tanks at Lyons Ferry FH (usually at about 800 fish/lb). Fish rear in intermediate tanks until July or when fish reach 100/lb, at which time they are transferred to outside raceways. Fish are ponded into two raceways at 85,000 fish/raceway (0.09 DI). By release, fish are at 0.27 DI, below Piper's recommendation of 0.5 DI
- At Lyons Ferry FH, raceways are supplied with oxygenated water from the hatchery's central degassing building. Approximately 1,000-gpm (23 minute exchange rate) of water enters each north side raceway through secondary degassing cans. The north side of the hatchery have historically been used to raise steelhead. The south side raceways will likely be included for steelhead rearing in the future due to program changes. South side raceways receive about 650 gpm (33.5 minute exchange rate) and enters the raceway through a manifold. Oxygen levels range between 10-12 ppm entering, to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Similar data are expected in the 2.1 acre rearing ponds (17.5 hour water exchange rate), but dissolved oxygen may be different upon exit due to lower densities, slower exchange rate, and greater amounts of algae in lake compared to raceways.

Flow index (FLI) is monitored monthly at all facilities and rarely exceeds 80% of the allowable loading. Raceways are cleaned three times a week by brushing to remove accumulated uneaten feed and fecal material. Feeding is by hand presentation. [2002 Lyons Ferry Complex Rainbow Trout HGMP, P 19-20]

- At Tucannon FH, rainbow trout (catchable program) are reared for 16 months until planting out to lakes. After early rearing inside, the fish go out to the round concrete ponds, then into the earthen pond from April to June. During early rearing, prior to transfer to the earthen pond, the Density Index is held below 0.4. in the troughs and circular ponds. At time of distribution, fish are flushed from the pond to the lower raceway where they are pumped out for transfer to various lakes. The earthen pond is dried out from June until August before fish come in September. *Ichthyophtherius* and *Trichodina* parasites (from Rainbow Lake hosts) can necessitate formalin treatment.

- In order to meet size at release Hatchery staff push feed before winter rearing temperatures result in fish being off feed for an approximate month time frame.

- Controlling predation by otters has been a challenge for hatchery staff. Otters climb over electric fence to feed in the earthen pond and can remove as many as 20,000 fish.

- Fry/fingerling are fed an appropriate commercial dry or moist steelhead/salmon diet. Fry feeding starts at ~8 times daily and is reduced as the fish increase in size. Range of feeding varies between 0.5 – 2.8% B.W./day. Feed conversion is expected to fall in a range of 1.1:1 (dry feed)– 1.4:1 (moist feed) pounds fed to pounds produced. Feeding frequency, percent BWD and feed size are adjusted as fish increase in size in accordance with good fish husbandry and program goals. [2002 Lyons Ferry Complex Rainbow Trout HGMP, P 21]

- A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Treatment for disease is provided by Hatchery Specialists under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning three times each week by brushing, and disinfecting equipment between raceways and/or between species on the hatchery site. [2002 Lyons Ferry Complex Rainbow Trout HGMP, P 21]

- Eyed eggs, fry, and larger juveniles are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by a WDFW fish health specialist, and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry are removed by bulb-syringe and the loss documented. Fry and larger juveniles are monitored throughout rearing, with necessary treatments based on mortality rates. [2002 Lyons Ferry Complex Rainbow Trout HGMP, P 19]

- Program protocols allow the release of only disease free fish into a particular watershed or body of water.

- Coldwater disease occurs annually and causes significant losses of fish in the raceways at Lyons Ferry FH.

- In the summer, the Tucannon FH operates on well/spring water because the Rainbow Lake water supply causes outbreaks of the *Ichthyophtherius* parasite and columnaris disease. Rainbow Lake water is not used until October although the water from the lake is plumbed to all units in the hatchery.

Release and Outmigration

- About 99,000 Spokane stock rainbow trout catchables (@ 2.5 fish per pound) and 500 jumbos (@ 1 fish per pound) are plant*ed by Lyons Ferr*y FH fish transport drivers into various lakes in southeast Washington. Planting begins in February and is completed in March.

- At the Tucannon FH, approximately 137,400 Spokane stock rainbow trout are planted into various lakes in southeast Washington as catchables. Planting typically begins in April, and is completed sometime in July. The jumbo trout (usually around 4,100) are planted in February through May each year, supplementing catchable plants. [Lyons Ferry FH Complex Annual Operations Plan 2008-2009, P 28]

- After the spring Chinook are released, Curl pond is stocked with resident trout for fishing.

- WDF&W has a policy that no rainbow trout will be released into waters containing anadromous fish even under an emergency situation.

- Fish Health requirements only allows the releases of healthy fish. Therefore, the chance of disease transfer to listed populations are greatly reduced.

Facilities and Operations

See the Lyons Ferry fall Chinook, Lyons Ferry hatchery steelhead, and Tucannon spring Chinook sections.

Research, Education, and Outreach

- WDFW Fish Management staff conducts angler counts and interviews.

- Vertical transmission studies on *Flavobacterium psychrophilum*, causative agent of coldwater disease, have been conducted by the WDFW Fish Health Specialist. Brood adult rainbow trout at the Spokane FH were injected with florfenicol or erythromycin prior to spawning in an attempt to reduce vertical transmission of the coldwater disease bacterium to the progeny. Progeny from the treated adults were reared at both Tucannon FH and at Lyons Ferry FH to ascertain efficacy of treatment. Neither antibiotic proved efficacious in reducing coldwater disease in the progeny. The following year, all of the three year old female rainbow brood were injected with florfenicol, with the same results, i.e., coldwater disease remained unabated in the progeny.

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[91] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- Limited harvest data exists for the rainbow trout program. The WDFW Tucannon Lakes Fishery Monitoring Report for 2003 (Mendal and Trump) stated the angler effort to be 38,116 angler hours and 19749 angler days. The report further states "This partial fishing season estimate of angler days exceeded 29% of the LSRCP mitigation goal of 67,500 angler days for southeast Washington".

- The IDFG has no harvest data for the rainbow trout provided by the Lyons Ferry FH.

Conservation Benefits

- Lyons Ferry FH rainbow trout program has no conservation benefit for the non-anadromous waters in southern Idaho.

Research, Education, Outreach and Cultural Benefits

- Hatchery staff provide educational and outreach opportunities on-site.

- The Tucannon Lakes provides an estimated 1/8.9 cost benefit (Tucannon Lakes Fishery Monitoring Report for 2003).

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[92] the Review Team identified the following benefits of this program:

Harvest Benefits

- Anglers benefit in areas throughout southeast Washington and north Idaho where rainbow trout are planted.

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Hatchery staff provide educational and outreach opportunities to the public .

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[91] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*
[92] *Ibid.*

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[93] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- None Identified.

Demographic Risks

- Fish may be stressed or loss during transport.
- Fish reared in uncovered rearing units at Lyons Ferry FH and Tucannon FH are subject to potential bird predation and disease vectored by birds.

Ecological Risks

- None identified

Physical Risks

- None identified

Research, Education, Outreach and Cultural Risks

- None identified

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[94] the Review Team identified the following risks from the hatchery program:

Genetic Risks

- Lyons Ferry rainbow trout(Spokane Stock) are not triploid and therefore may pose a risk of inter breeding with native stocks (i.e. fish escaping from Tucannon Lakes into the Tucannon River).
- Fish transferred to Idaho are placed in landlocked lakes and reservoirs managed for put and take fisheries and pose no risk to anadromous species.

Demographic Risks

- Rearing rainbow trout at Lyons Ferry FH may jeopardize anadromous stocks due to the demand for rearing space and water.

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[93] *Ibid.*
[94] *Ibid.*

- Amplification of coldwater disease in rainbow trout held at Tucannon FH may pose risks to fish downstream of the facility.

Ecological Risks

- Rainbow trout are stocked in non-anadromous waters (land-locked or screened lakes).
- Rainbow trout stocked into the Tucannon Lakes may escape into the Tucannon River and may interbreed and compete with wild spawning anadromous stocks.
- Disease epizootics during rearing may pose a health risk to anadromous stocks on station.
- Rainbow trout pose a competition risk to other trout stocks and species where fish are outplanted.

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program[95]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue LF-RT1: *Limited data exists regarding the program's ability to meet LSRCP mitigation goals. WDFW has extrapolated data for the several lakes they stock from two lakes in the Tucannon River watershed to estimate harvest effort in relation to LSRCP mitigation goals; however, IDFG has not performed a similar assessment for the lakes stocked in Idaho.*

Recommendation LF-RT1: IDFG should develop a monitoring program to determine if the Spokane rainbow trout program is meeting LSRCP mitigation goals. WDFW should continue to make efforts to monitor the program on a periodic basis.

Broodstock Choice and Collection

None identified.

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[95] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

Hatchery and Natural Spawning, Adult Returns

Not applicable.

Incubation and Rearing

Issue LF-RT2: Coldwater disease is an annual problem in the rainbow trout when they reach 100-200 fish per pound, after ponding. *Past studies examined the use of antibiotic injections of the female broodstock at the Spokane FH in an effort to reduce the potential of vertical transmission of the disease bacterium to the offspring, but found no efficacy.*

Recommendation LF-RT2: Investigate use of another stock of rainbow trout with fewer problems with coldwater disease. Consider additional rinsing and disinfection of eggs as per the protocols developed by the Warm Springs Hatchery (California Fish & Game) where ovarian fluid is drained and the eggs are rinsed with 0.9% saline before fertilization. After fertilization, rinse and disinfect eggs in 100 ppm iodophor.

See Issues LF-SS7 and LF-SS8 (or Issues CC-SS7 and CC-SS8).

Release and Outmigration

Issue LF-RT3: Pre-release exams which include testing for virus, bacteria and parasites are not done at the Lyons Ferry FH Complex and associated acclimation sites. *There is a potential risk that endemic or vertically transmitted diseases might be undetected in released juveniles. This could affect their future survival and/or infected fish could serve as vectors in infecting other aquatic animals . Pre-release inspections, done 4-6 weeks before release or transfer are required by USFWS fish health policy FW 713.*

Recommendation LF-RT3: Sample 60 fish for pre-release inspections to meet the American Fisheries Society – Fish Health Section Blue Book requirements to ensure a 95% confidence in detecting pathogens at the minimum assumed pathogen prevalence level of 5%. Additional testing for non-reportable pathogens, such as Flavobacterium psychrophilum and Nucleospora salmonis, may be informative for co-managers.

Facilities/Operations

Issue LF-RT4: Fish reared in outside circular tanks at Lyons Ferry FH are subject to bird predation.

Recommendation LF-RT4: Install cover or totally enclose tank pad (see LF-SS12). .

Research, Monitoring, and Accountability

Refer to Program Goals and Objectives Issue and Recommendation LF-RT1 and LF-RT3.

Education and Outreach

Refer to the Lyons Ferry Fall Chinook section

Alternatives to Current Program

The Review Team considered the benefits and risks of the existing Spokane rainbow trout program at Lyons Ferry FH and developed three alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no program" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

Alternative 1: Current program with recommendations

This alternative represents the current Spokane stock rainbow trout program at Lyons Ferry FH with implementation of all recommendations. These recommendations include increased monitoring and evaluation efforts by WDFW and IDFG to determine if the program's LSRCP mitigation goals are being met.

Pros

- Maintains the program at its current level.
- Develops important resident trout fishery data for effective management of the program.

Cons

- Increases the cost of monitoring and evaluation activities for the program.

Alternative 2: Transfer the Spokane rainbow trout to an WDFW inland trout facility

Pros

- Frees up rearing space and water at Lyons Ferry FH for existing anadromous programs.

Cons

- There may be a cost associated with the transfer of production if improvements are required at another facility so that it can accommodate the Spokane rainbow trout program.
- May increase costs for transporting fish to their release locations.

Alternative 3: Terminate the program

Pros

- Frees up rearing space and water at Lyons Ferry FH for existing anadromous programs.
- Reduces operational costs associated with rearing and transport of fish.
- Eliminates fish health issues associated with this program.

Cons

- Reduces or eliminates rainbow trout harvest opportunities in the inland waters where these fish are released.

Recommended Alternatives

The Review Team recommends Alternative 2: transfer the Spokane rainbow trout to a WDFW inland trout facility. Based on the review of all the other production programs a Lyons Ferry FH and the limited rearing space and water available, the Spokane rainbow trout program should be accomplished at one of the WDFW inland trout facilities. For the Lyons Ferry FH, the Review Team has made specific recommendations regarding reducing early rearing densities for steelhead. The elimination of the Spokane rainbow trout program will free up early rearing space for the steelhead and other existing anadromous programs. In addition, cold water disease has been an issue for both Lyons Ferry steelhead and the Spokane rainbow trout. The elimination of this program may make it easier to manage for cold water disease in the Lyons Ferry steelhead. The transfer of the program to a WDFW inland trout hatchery will provide continued harvest opportunities for a very popular trout fishery. In summary, Alternative 2 will eliminate fish health risks associated with the Spokane rainbow trout program and will simplify the overall production program at Lyons Ferry.

Kamloops Rainbow Trout

Operator: Washington Department of Fish and Wildlife

Summary of Current Program

Goals

- ***Harvest goal:*** No quantified harvest goal currently exists for this program. The goal of the trout programs associated with LFC hatcheries is to compensate for the loss of 67,500 angler-days of fishing (Washington and Idaho) to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams. The Kamloops Rainbow Trout program addresses fish for release in Idaho Rivers (lower Salmon River and lower Clearwater River).

- ***Broodstock escapement goal:*** N/A***,*** eggs for the trout program are received from IDFG's Hayspur FH

- ***Conservation goal:*** The hatchery program has no established broodstock goal.

- ***Escapement goal for natural-origin adults:*** The hatchery program has no established escapement goal.

- ***Research, education, and outreach goals:*** Annual hook-and-line monitoring is conducted in the lower Clearwater and Salmon rivers to determine the relative contribution of program fish to the creel and to collect stomachs for subsequent diet analysis. Sampling generally occurs during the month of August.

Objectives

- Rear 50,000 fingerling Kamloops (triploid) rainbows (approximately 3,333 pounds or 1,512 kg) at Lyons Ferry FH and Tucannon FH for planting in the lower 100 miles (161 km) of the Salmon River and the lower 70 miles (113 km) of the Clearwater River in Idaho. This requires 70,000 triploid eyed Kamloops stock eggs (provided by IDFG from Hayspur FH) to meet part of the LSRCP mitigation requirement within Idaho. IDFG prefer to use Kamloops stock because of the survival advantage they exhibit over the Spokane stock (Spokane FH) when released into the Clearwater and Salmon Rivers.

Program Description

WDFW manages two hatcheries to produce resident trout for the LSRCP Program. This is a segregated mitigation program. When originally proposed, the trout program was to produce 233,000 trout at 2.5 fish per pound for a total of about 93,000 pounds. However, this production goal was adjusted to 86,000 pounds due to habitat mitigation efforts. Lyons Ferry FH was designed to rear 45,000 pounds of trout for release into Washington and Idaho waters. Tucannon FH, was designed to rear 41,000 pounds for the compensation program. Eggs for the trout program are received from WDFW's Spokane FH. Lyons Ferry FH receives approximately 52,000 Kamloops stock rainbow trout from Tucannon FH in July each year. They are reared in raceways until August or September, when they are adipose fin clipped and either a right or left ventricle fin clipped (alternating years). In

October, IDFG transports and plants the entire population (usually around 50,000 fish) in Idaho Rivers (lower Salmon River and lower Clearwater River), at 15 fish per pound.

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- Not applicable

Incubation and Rearing

- 65,000 Kamloops eyed eggs for Idaho's fingerling program are Kamloops stock, from IDFG's Hayspur Hatchery. These eggs are shipped to the Tucannon FH in January each year. [Lyons Ferry FH Complex Annual Operation Report October 1, 2005 thru September 30, 2006, P 29]

- Eyed eggs received from Spokane Hatchery hatch from baskets at Lyons Ferry FH or Tucannon FH and drop into troughs where they remain for 4-8 weeks after feeding commences. Fish are fed after most are buttoned up (usually 1-3 days post swim up). [2002 Lyons Ferry Complex Rainbow Trout HGMP, P 19] A

- At Tucannon FH , after initial rearing in troughs, they are transferred to outside circular tanks for intermediate rearing. In July at 75 fish per pound, they are transferred to Lyons Ferry FH for marking and final rearing. [Lyons Ferry FH Complex Annual Operation Report October 1, 2005 thru September 30, 2006, P P 29]

- A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Treatment for disease is provided by Hatchery Specialists under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning three times each week by brushing, and disinfecting equipment between raceways and/or between species on the hatchery site. [2002 Lyons Ferry Complex Rainbow Trout HGMP, P 21]

- Eyed eggs, fry, and larger juveniles are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by a WDFW fish health specialist, and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry are removed by bulb-syringe and the loss documented. Fry and larger juveniles are monitored throughout rearing, with necessary treatments based on mortality rates. [2002 Lyons Ferry Complex Rainbow Trout HGMP, P 19]

- To reduce problems with coldwater disease, fish numbers are limited to 8,000 fish/trough during early rearing. Fish are hand fed twice/day to control growth to further reduce problems with coldwater disease. Maintaining Density Index below 0.5 is standard procedure at Tucannon FH.

- Fish go out to round ponds at 40,000/pond in early April and are split out into the races in August. Fish are moved into the earthen pond. Cold water disease occurs periodically in one or more of the round ponds which may or may not necessitate antibiotic treatment.

- Rearing temperatures range from 48-54°F.

Release and Outmigration

- In October, IDFG transports and plants the entire population (usually around 50,000 fish) in Idaho Rivers (lower Salmon River and lower Clearwater River), at 15 fish per pound

- IDFG receives 160,000 Spokane stock rainbow trout fry and transports these fish to designated Idaho waters (inland lakes and ponds) in April or May, at around 60-80 fish per pound. [Lyons Ferry FH Complex Annual Operations Plan 2008-2009, P 28]

Facilities and Operations

See the Lyons Ferry fall Chinook, Lyons Ferry hatchery steelhead, and Tucannon spring Chinook sections.

Research, Education, and Outreach

- WDFW Fish Management staff conducts angler counts and interviews.

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[96] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- Although IDFG samples the lower Clearwater and lower Salmon rivers to determine the presence/absence of program fish, harvest benefits are not adequately documented.

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Fish released into the Clearwater and Salmon rivers are adipose clipped with a ventral clip alternating yearly.

[96] *See Section II, "Components of This Report", for a description of these potential benefits and risks.*

- Annual hook-and-line monitoring is conducted in the lower Clearwater and Salmon rivers to determine the relative contribution of program fish to the creel and to collect stomachs for subsequent diet analysis. Sampling generally occurs during the month of August. [2002 IDFG Rainbow Trout HGMP, P 8]

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[97] the Review Team identified the following benefits of this program:

Harvest Benefits

- Anglers benefit in areas throughout the lower Salmon and Lower Clearwater rivers in Idaho where these fish are planted.

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- IDFG staff provide educational and outreach opportunities to the public.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[98] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- None identified.

Demographic Risks

- Rainbow trout circular tanks at Tucannon FH are not covered to deter bird predation
- Rainbow trout stocked in Rainbow Lake above Tucannon FH pose a disease threat to hatchery production.

Ecological Risks

- None identified.

Physical Risks

- Fish may be stressed or loss during transport.

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[97] *Ibid.*
[98] *Ibid.*

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[99] the Review Team identified the following risks from the hatchery program:

Genetic Risks

- Stocked fish are triploid minimizing the potential to breed with native stocks.

Demographic Risks

- The rainbow trout program places a demand on rearing space and water supply in competition with the anadromous program.

- Amplification of coldwater disease in Kamloops trout held at Tucannon FH may pose risks to fish downstream of the facility.

Ecological Risks

- Fish may prey on anadromous stocks (i.e. fall Chinook in lower Clearwater River).

- Disease outbreaks pose a fish health risk to other stocks on station and to other trout stocks where the fish are outplanted.

Research, Education, Outreach and Cultural Risks

- None identified.

[99] *Ibid.*

Recommendations for Current Program[100]

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue LF-RT5: Although IDFG samples the lower Clearwater and lower Salmon rivers to determine the presence/absence of program fish, sport fishery contribution data specific for this program is not available.

Recommendation LF-RT5: Establish a monitoring program to determine fishery contribution of Kamloops rainbow trout and if it is meeting LSRCP mitigation goals. If fishery contributions are low, consider moving the programs to lakes or reservoirs with increased harvest potential.

Broodstock Choice and Collection

None identified.

Hatchery and Natural Spawning, Adult Returns

None identified.

Incubation and Rearing

None identified.

Release and Outmigration

Issue LF-RT6: Kamloops rainbow trout stocked in the lower Salmon and lower Clearwater rivers may prey on anadromous stocks (i.e. fall Chinook in lower Clearwater River).

Recommendation LF-RT6: Increase sampling efforts to determine the extent of predation on anadromous fish. If the predation is determined to be significant, then discontinue stocking anadromous waters and seek a stocking location (landlocked waters) absent anadromous fish.

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[100] *The Review Team believes that the WDFW and the LSRCP office will be the logical parties to coordinate to implement most of the following recommendations.*

Issue LF-RT7: Pre-release exams which include testing for virus, bacteria and parasites are not done at the Lyons Ferry FH Complex and associated acclimation sites. *There is a potential risk that endemic or vertically transmitted diseases might be undetected in released juveniles. This could affect their future survival and/or infected fish could serve as vectors in infecting other aquatic animals . Pre-release inspections, done 4-6 weeks before release or transfer are required by USFWS fish health policy FW 713.*

Recommendation LF-RT7: Sample 60 fish for pre-release inspections to meet the American Fisheries Society – Fish Health Section Blue Book requirements to ensure a 95% confidence in detecting pathogens at the minimum assumed pathogen prevalence level of 5%. Additional testing for non-reportable pathogens, such as Flavobacterium psychrophilum and Nucleospora salmonis, may be informative for co-managers.

Facilities/Operations

See Recommendation LF-RT4 and LF-SS12 to install a cover or enclosure over the tank pad at Lyons Ferry FH.

Research, Monitoring, and Accountability

Refer to Program Goals and Objectives Issue and Recommendation LF-RT5 and LF-RT7.

Education and Outreach

See the Lyons Ferry Fall Chinook and Tucannon Spring Chinook sections for Education and Outreach issues and recommendations regarding Lyons Ferry FH and Tucannon FH.

Alternatives to Current Program

The Review Team considered the benefits and risks of the existing Kamloops rainbow trout program at Lyons Ferry FH and developed three alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified recommended alternatives.

Alternative 1: Current program with recommendations

This alternative represents the current rainbow trout program at Lyons Ferry FH with implementation of all recommendations. These recommendations include increase fishery monitoring efforts to

determine if LSRCP mitigation goals are being met and increase monitoring to determine if predation of anadromous fish is significant.

Pros

- Generates data to better understand affects of program on anadromous fish.
- Maintains the program at its current level.
- Develops important resident trout fishery data for effective management of the program.

Cons

- Increases the cost of monitoring and evaluation activities for the program.

Alternative 2: Transfer Kamloops rainbow trout program to another facility

Discontinue rainbow trout production at Lyons Ferry FH and Tucannon FH and move production to another facility.

Pros

- Frees up rearing space and water at Lyons Ferry FH for existing anadromous programs.

Cons

- There may be a cost associated with the transfer of production if improvements are required at another facility so that it can accommodate the Spokane rainbow trout program.
- May increase costs for transporting fish to their release locations.

Alternative 3: Terminate the program

Pros

- Frees up rearing space and water at Lyons Ferry FH for existing anadromous programs.
- Reduces operational costs associated with rearing and transport of fish.
- Eliminates fish health issues associated with this program.
- Eliminates potential for predation of fall Chinook by LSRCP program Kamloops trout released in the lower Salmon and lower Clearwater rivers.

Cons

- Reduces or eliminates rainbow trout harvest opportunities in the waters where these fish are released.

Recommended Alternatives

The review team selected Alternative 2: transfer Kamloops rainbow trout program to another facility. Based on the review of all the other production programs at Lyons Ferry and Tucannon FHs, the transfer of the rainbow trout program to another facility would free up resources that could be used for existing anadromous programs at both facilities. It also eliminates any fish health risks associated with this program, simplifies the overall production process at Lyons Ferry and Tucannon FHs, and maintains a recreational harvest opportunity.

VI. Conclusions

Text

Appendices

ALL APPENDICES WILL BE AVAILABLE UPON DISTRIBUTION OF THE FINAL REPORT

Appendix A: All-H Analyzer (AHA) output for salmon and steelhead stocks in the xxx River Watersheds

Available from the Pacific Region Federal Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Appendix B: Washington LSRCP Facilities Briefing Document

Available from the Pacific Region Federal Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Appendix C: Comments on Draft Report and Review Team Responses

Available from the Pacific Region Federal Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Appendix D. Complete Text of Comment Letters Received from Stakeholders

Available from the Pacific Region Federal Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Appendix E: Washington LSRCP Facilities Operations and Maintenance Costs Summary

Available from the Pacific Region Federal Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Pacific Region Fishery Resources
911 NE 11th Avenue
Portland, OR 97232
503/872.2763
E-Mail: Douglas_dehart@fws.gov

U.S. Fish and Wildlife Service
www.fws.gov

For Columbia River Basin Hatchery Review Information
www.fws.gov/pacific/Fisheries/Hatcheryreview/

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people.

September 2009